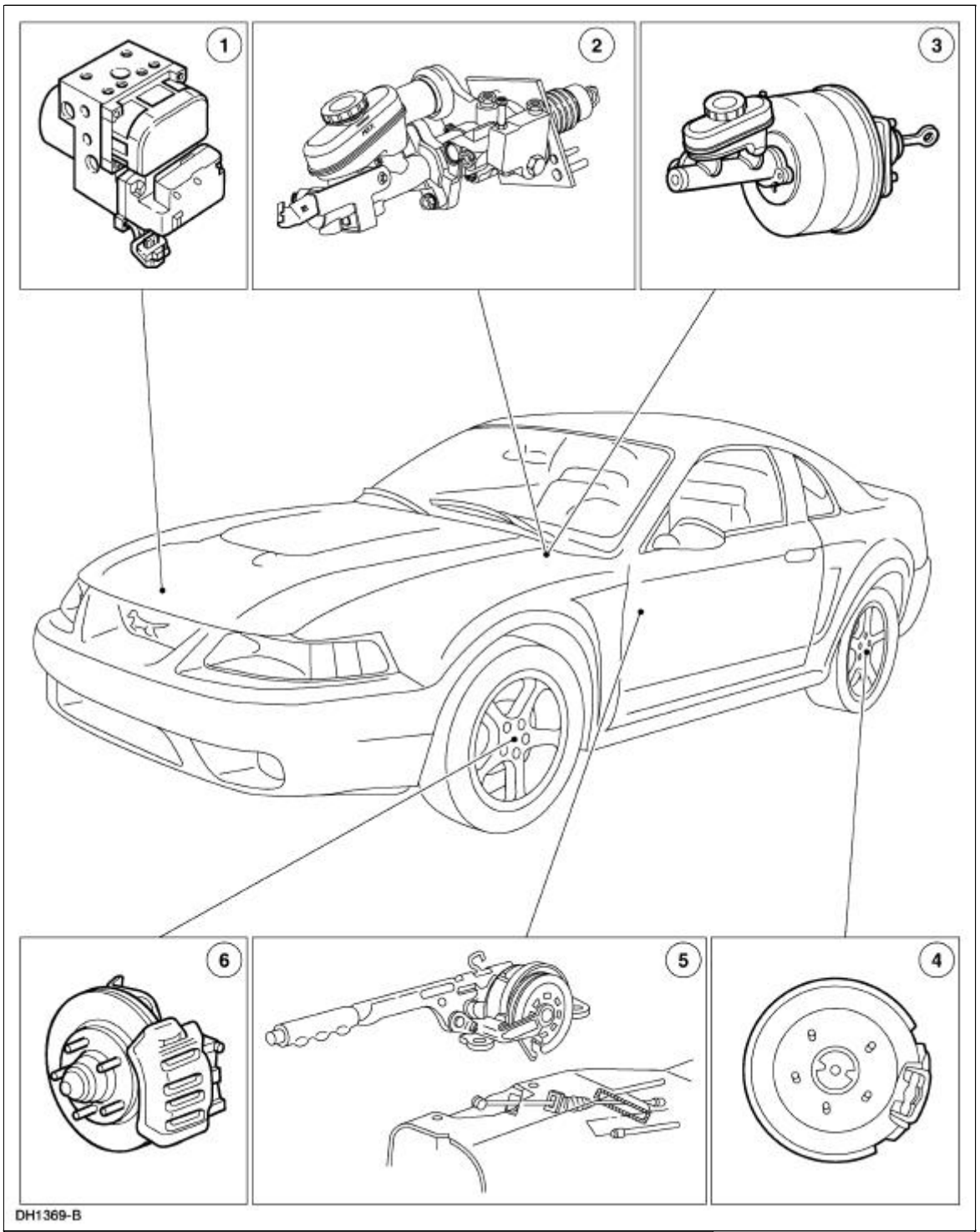
Torque Specifications

Description	Nm	lb-ft	lb-in
Front disc brake caliper bleeder screw	12-18	9-13	—
Front master cylinder brake tube	22-28	17-20	—
Rear bleeder screw	20	15	—
Rear master cylinder brake tube	15-20	11-14	—
Master cylinder bleeder screws	9	—	80

Brake System

Component Locations



Item	Part Number	Description
1	2C346	Four wheel anti-lock brake system (4WABS)

		hydraulic control unit and control module assy (non-traction)
1	2C353	Four wheel anti-lock brake system (4WABS) hydraulic control unit and control module assy (traction)
2	2B559	Hydro-Boost brake booster and brake master cylinder assy
3	2B195	Vacuum brake booster and brake master cylinder assy
4	2K327	Rear disc brake assy
5	2780	Parking brake control
6	2B119	Front disc brake assy

The vehicle is equipped with a vacuum-assisted or a hydro-boost power braking system. Refer to Section 206-07 .

The braking system is a front-to-rear split hydraulic system. Refer to Section 206-06 .

The front wheel brakes utilize a dual piston brake caliper and disc brake system. Refer to Section 206-03 .

The rear brakes utilize a single piston brake caliper and disc brake system. Refer to Section 206-04 .

The parking brake system is a mechanical system that is controlled by an independent hand-operated parking brake control and is self-adjusting. Refer to Section 206-05 .

A 4-wheel anti-lock brake system or anti-lock brake system with traction control (4WABS) is optional equipment on all models except Cobra. Cobra has ABS and traction control as standard equipment. Refer to Section 206-09A .

Brake System

Refer to Wiring Diagrams Cell 60 , Instrument Cluster for schematic and connector information.

Refer to Wiring Diagrams Cell 97 , Daytime Running Lamps for schematic and connector information.

Special Tool(s)

ST1137-A	73 Digital Multimeter 105-R0051 or Equivalent
ST2206-A	ABS Brake and Pressure Test Kit 107-02350 or Equivalent
ST1687-A	Tire and Wheel Runout Gauge Set 134-00199 or Equivalent

Inspection and Verification

WARNING: Use of any other than the approved DOT 3 brake fluid will cause permanent damage to brake components and will render the brakes inoperative.

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

CAUTION: Do not spill brake fluid onto painted surfaces. If spilled, wipe up immediately.

NOTE: Always check the fluid level in the brake master cylinder reservoir (2K478) before performing the test procedures. If the fluid level is not at the correct level, add High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A.

NOTE: Prior to performing any diagnosis, make sure the brake warning indicator is functional. For additional information, refer to Section 413-01 .

The first indication that something may be wrong in the brake system is a change in the feeling through the brake pedal (2455). The brake warning indicator in the instrument cluster and the brake fluid level

in the brake master cylinder reservoir are also indicators of system concerns.

If a wheel is locked and the vehicle must be moved, open a bleeder screw at the locked wheel (1007) to let out enough fluid to relieve the pressure. Close the bleeder screw. This bleeding operation may release the brakes but will not correct the cause of trouble. If this does not relieve the locked wheel condition, repair the locked components before proceeding.

Inspect all hoses and connections. All unused vacuum connectors should be capped. Make sure hoses and their connections are correctly secured and in good condition with no holes, soft or collapsed areas.

Non-Pressure Leaks

The only part of the brake system that could have a brake fluid loss that does not appear when the system is under pressure is the brake master cylinder reservoir area. Brake fluid loss can be caused by a missing or poorly-fitted brake master cylinder filler cap (2162), a punctured or otherwise damaged brake master cylinder reservoir, a missing or damaged brake master cylinder filler cap gasket, or by missing, damaged or poorly-fitted sealing grommets between the brake master cylinder (2140) and the brake master cylinder reservoir.

The brake master cylinder reservoir grommets are not separately serviceable and must be installed new as part of a new brake master cylinder reservoir.

Install a new flexible brake hose if it shows signs of softening, cracking or other damage.

When installing a new brake hose, position the hose to avoid contact with other vehicle components.

Road Test

Perform a road test to compare actual vehicle braking performance with the performance standards expected by the driver. The ability of the test driver to make valid comparisons and detect performance deficiencies will depend on experience.

The driver should have a thorough knowledge of brake system operation and accepted general performance guidelines in order to make good comparisons and detect performance problems.

Select a road that is reasonably smooth and level. Gravel or bumpy roads are not suitable because the surface does not allow the tires to grip the road equally. Avoid crowned roads.

A key factor in evaluating brake concerns is the deceleration rate. This varies from vehicle to vehicle and with changes in operating conditions. It is evident how well the brakes are working after just a few applications.

Avoid locking the brakes. Locked brakes are not an indication of braking efficiency.

Visual Inspection Chart

Mechanical	Electrical
• Brake master cylinder • Brake caliper piston • Brake discs • Brake pads	• Parking brake switch • Damaged or corroded wiring harness • Brake master cylinder fluid level switch

• Power brake booster • Brake pedal linkage • Vacuum booster hose • Tires • Foreign material	

For low or spongy brake pedal concerns:

- check and, if necessary, refill the brake master cylinder reservoir.
- bleed the brake system and retest the brake pedal feel.
- if the brake pedal is still low or feels spongy, check the brake pedal mounting for looseness and correct installation. Check the power brake booster and the brake master cylinder for loose mounting. Correct as necessary and retest the system for normal operation.

For a slow or incomplete brake pedal return concern:

- inspect for binding, damage, correct installation or interference at the brake pedal.
- check the power brake booster for binding, damage and correct installation.

Vibration When Brakes are Applied

For vibration concerns when brakes are applied, perform the following procedure.

Visually inspect:

- tire condition and pressure.
- suspension bushings and ball joints.

Correct as necessary.

1. Verify and isolate the concern. Brake roughness can be felt in:
   - the steering wheel.
   - the seat.
   - the brake pedal.
2. After verifying the concern, check for related concerns in the:
   - On-Line Automotive Service Information System (OASIS).
   - Technical Service Bulletins.
3. Check wheel bearing end-play and correct as necessary.
4. **NOTE:** Begin at the front of the vehicle unless the vibration has been isolated to the rear.

   Remove the tire and wheel.
5. Remove the brake caliper.
6. Measure and record the brake disc thickness. Install a new brake disc if the thickness after machining will be at or below specification. The specification is molded into the brake disc. Do

not machine a new brake disc.

7. For vehicles with a two-piece hub and brake disc assembly:
   - Match-mark before disassembly.
   - Remove the brake disc.
   - Using a die grinder with a mild abrasive (Scotch Brite® type), remove any rust or corrosion from the hub and brake disc mounting surfaces.
   - Align the match-marks and reinstall the brake disc on the hub.

8. **CAUTION: Do not use a bench lathe to machine brake discs.**

   NOTE: The depth of cut must be between 0.10 and 0.20 mm (0.004 and 0.008 inch). Lighter cuts will cause heat and wear. Heavier cuts will cause poor brake disc surface finish.

   Using on-vehicle brake lathe, machine the brake discs. Follow the manufacturer's instructions. After machining, make sure the brake disc still meets the thickness specification.

9. Using a dial indicator, verify that the brake disc lateral runout is now within vehicle specification.

10. Remove any metal chips.

11. Remove the hub adapter.

12. Remove any remaining metal chips from the machining operation.

13. **CAUTION: Do not carry out this step on rear drum-in-hat brake discs.**

    For vehicles with a two-piece hub and a non drum-in-hat brake disc assembly:
    - Remove the brake disc from the hub.
    - Remove any remaining metal chips from hub and brake disc mounting surfaces and from the ABS sensor.
    - Apply High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA to the mounting surfaces.
    - Using the match-marks, mount the brake disc on the hub.

14. Install the caliper and check brake operation.

Symptom Chart

Symptom Chart

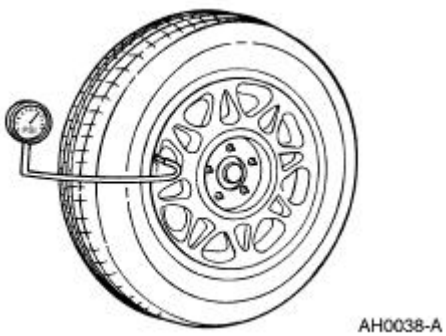
Condition	Possible Sources	Action
● The Brakes Pull or Drift	● Tire air pressure. ● Wheel alignment. ● Brake pads. ● Brake components. ● Suspension component.	● Go To Pinpoint Test A .
● The Red Brake Warning Indicator Is	● Instrument cluster. ● Circuit.	● Go To Pinpoint Test B .

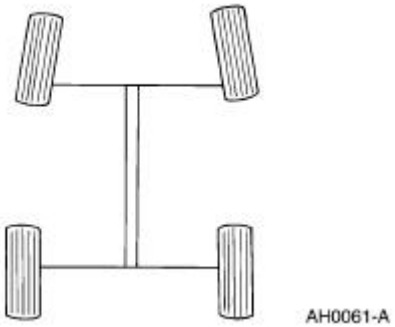
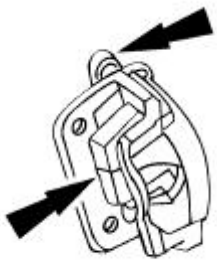
Always On	• Parking brake. • Brake fluid level.	
• Vibration When Brakes Are Applied	• Rear disc brakes. • Front disc brakes.	• REFER to Section 100-04 .
• Brake Pedal Goes Down Fast	• Brake fluid level. • Air in system. • Brake master cylinder.	• FILL the brake master cylinder reservoir. BLEED the system. • BLEED the system. • PERFORM the brake master cylinder component test in this section.
• The Brake Pedal Eases Down Slowly	• Air in system. • Brake master cylinder.	• BLEED the system. REFER to Bleeding — System in this section. • PERFORM the brake master cylinder component test in this section.
• Brake Lockup During Light Brake Pedal Force	• Disc brake component. • Parking brake component. • Anti-lock brake control system.	• Go To Pinpoint Test C .
• Excessive/Erratic Brake Pedal Travel	• Leak in hydraulic system. • Air in system. • Disc brake caliper. • Brake master cylinder.	• Go To Pinpoint Test D .
• Brakes Drag	• Parking brake component. • Disc brake caliper. • Brake booster-to-brake master cylinder push rod adjustment. • Brake master cylinder.	• REPAIR or INSTALL new components as necessary. REFER to Section 206-05 . • REPAIR or INSTALL a new brake caliper as necessary. REFER to Section 206-03 and Section 206-04 . • ADJUST the push rod. REFER to Section 206-07 . • PERFORM the brake master cylinder component test in this section.
• Excessive Brake Pedal Effort	• Power brake booster. • Power brake booster check valve (2365). • Power brake booster hose.	• PERFORM the brake booster component test in this section. • PERFORM the check valve component test in this section. • REROUTE, REPAIR or INSTALL a new brake

		booster hose as necessary.
• Red Brake Warning Indicator Inoperative	• Circuit. • Bulb.	• REFER to Section 413-01 .
• Brake Noise	• Disc brake component.	• MACHINE or INSTALL a new brake component as necessary. REFER to Section 206-03 or Section 206-04 .
• Hydro-Boost, No Power Assist	• Power steering pump. • Linkage. • Power steering fluid flow. • Hydro-boost unit.	• Go To Pinpoint Test E .
• Hydro-Boost Erratic Operation, Sticks, Binds or Grabs	• Supply hose. • Hydro-boost unit.	• Go To Pinpoint Test F .
• Hydro-Boost Brake System Operation Suspect	• Leakage. • Hydro-boost unit.	• Go To Pinpoint Test G .

Pinpoint Tests

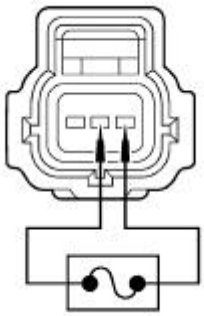
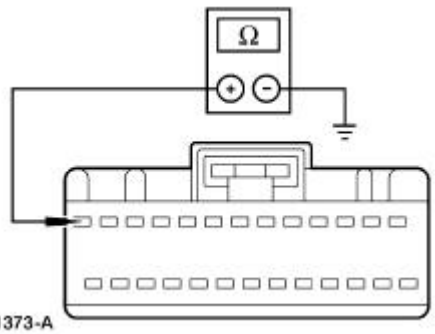
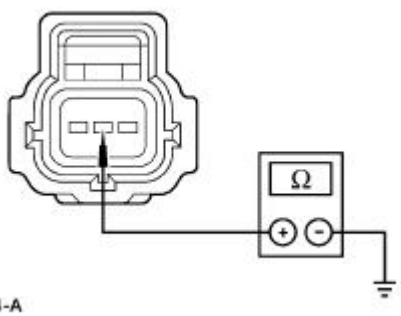
PINPOINT TEST A: THE BRAKES PULL OR DRIFT

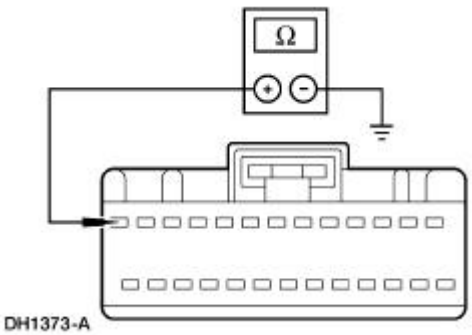
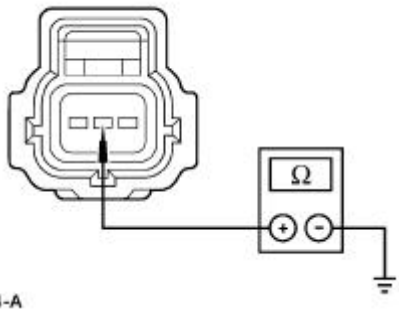
Test Step	Result / Action to Take
A1 CHECK THE TIRES	
NOTE: Check tire pressure with the brakes off. • Check tires for uneven and excessive wear and for correct pressure.  AH0038-A • **Are the tires OK?**	**Yes** GO to A2 . **No** CORRECT as necessary. RETEST for normal operation.
A2 CHECK THE ALIGNMENT	
• Check the caster, camber and toe. Refer to Section 204-00 .	**Yes** GO to A3 . **No** CORRECT alignment as necessary. REFER to Section 204-00 . RETEST for correct operation.

 AH0061-A ● **Is the alignment OK?**	
A3 CHECK THE DISC BRAKE COMPONENTS	**Yes** GO to A4 . **No** REPAIR or INSTALL new components as necessary. RETEST for normal operation.
● Check all disc brake calipers, anchor plate guide pins and brake pads for binding, wear, damage, contamination and correct installation.  AH0041-A ● **Are the disc brake calipers, anchor plate guide pins and brake pads OK?**	
A4 ROAD TEST THE VEHICLE	**Yes** REPAIR or INSTALL new front disc brake caliper or anchor plate guide pins on the side opposite to the direction of the drift or pull. **No** REPAIR or INSTALL new front disc brake caliper or anchor plate guide pins on the side of the vehicle in the direction of the drift or pull.
● Road test the vehicle, and observe whether the drift occurs with or without the brakes applied. ● **Does the drift or pull occur with the brakes applied?**	

PINPOINT TEST B: THE RED BRAKE WARNING INDICATOR IS ALWAYS ON

Test Step	Result / Action to Take
B1 CHECK THE BRAKE MASTER CYLINDER FLUID LEVEL SWITCH	
● Key in OFF position. ● Disconnect: Brake Master Cylinder Fluid Level Switch C124. ● Connect a fused jumper from C124-2 circuit 977 (PK/WH) to C124-3 circuit 128 (VT/YE).	**Yes** GO to B2 . **No** INSTALL a new brake master

 DH1372-A ● Key in ON position. ● **Does the brake warning indicator stay on?**	cylinder reservoir. TEST the system for normal operation.
B2 CHECK PARKING BRAKE SWITCH ● Key in OFF position. ● Disconnect: Parking Brake Switch. ● Key in ON position. ● **Does the brake warning light stay on?**	**Yes** GO to B3 . **No** INSTALL a new parking brake switch. TEST the system for normal operation.
B3 CHECK THE GEM ● Key in OFF position. ● Disconnect: GEM C201e. ● Measure resistance to ground at C201e-13.  DH1373-A ● **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the GEM. TEST the system for normal operation. **No** For vehicles without Daytime Running Lights (DRL), GO to B4 . For vehicles with DRL, GO to B5 .
B4 CHECK CIRCUITS 977 (VT/WH), 22 (LB/BK) AND 128 (VT/YE) ● Remove the fused jumper from C124. ● Measure the resistance to ground at C124-2.  DH1374-A ● **Is the resistance greater than 10,000 ohms?**	**Yes** REPAIR the ground short in circuit 128 (VT/YE). TEST the system for normal operation. **No** REPAIR the ground short in circuit 977 (VT/WH) or circuit 22 (LB/BK). TEST the system for normal operation.
B5 CHECK CIRCUIT 128 (VT/YE) ● Remove the fused jumper from C124. ● Measure the resistance to ground at C201e-13.	**Yes** GO to B6 .

 DH1373-A ● **Is the resistance greater than 10,000 ohms?**	**No** REPAIR the ground short in circuit 128 (VT/YE). TEST the system for normal operation.
B6 CHECK DAYTIME RUNNING LIGHTS (DRL) MODULE	**Yes** REPAIR the DRL module. TEST the system for normal operation. **No** REPAIR the ground short in circuit 22 (LB/BK) or 977 (VT/WH). TEST the system for normal operation.
● Disconnect: DRL Module C1030. ● Measure the resistance to ground at C124-2.  DH1374-A ● **Is the resistance greater than 10,000 ohms?**	

PINPOINT TEST C: BRAKE LOCKUP DURING LIGHT BRAKE PEDAL FORCE

Test Step	Result / Action to Take
C1 INSPECT THE TIRES	**Yes** GO to C2 . **No** CORRECT as necessary. RETEST for normal operation.
● Inspect the tires for uneven or excessive wear, correct pressure, correct size and type. ● **Are the tires OK?**	
C2 CHECK THE BRAKE CALIPER COMPONENTS	**Yes** GO to C3 . **No** CORRECT as necessary. RETEST for normal operation.
● Inspect the brake pads and brake discs for wear, damage, contamination and correct installation. ● **Are the brake components OK?**	
C3 CHECK THE PROPORTIONING VALVE	**Yes** INSPECT the disc brake calipers and INSTALL new calipers as necessary. RETEST for normal operation. **No**
● Install the gauges from the ABS brake and pressure test kit on one front and one rear bleeder screw. ● Apply 6895 kPa (1000 psi) to the front brake system. ● **Is the pressure in the rear system 3516-**	

4481 kPa (510-650 psi)?	INSTALL a new proportioning valve. RETEST for normal operation.

PINPOINT TEST D: EXCESSIVE/ERRATIC BRAKE PEDAL TRAVEL

Test Step	Result / Action to Take
D1 CHECK FOR SPONGY PEDAL ● Key in ON position. ● Operate the brake pedal and note pedal feel. ● **Does the pedal feel spongy?**	**Yes** BLEED the brake system. REFER to Bleeding — System in this section. RETEST for normal operation. **No** GO to D2 .
D2 CHECK THE BRAKE PEDAL ● Inspect the brake pedal and bracket for binding, obstruction or damage. ● **Is the brake pedal OK?**	**Yes** GO to D3 . **No** REPAIR or INSTALL a new brake pedal as necessary. RETEST for normal operation.
D3 CHECK THE BRAKE COMPONENTS ● Inspect the calipers bolts, anchor plate bolts and anti-rattle springs for binding, damage, contamination and correct installation. ● **Are the bolts and springs OK?**	**Yes** GO to D4 . **No** REPAIR or INSTALL new components as necessary. RETEST for normal operation.
D4 CHECK THE BOOSTER AND MASTER CYLINDER ● Check the power brake booster and brake master cylinder for correct installation and correct push rod adjustment. Refer to Section 206-06 and to Section 206-07 . ● **Are the power brake booster and the brake master cylinder OK?**	**Yes** INSPECT the front wheel bearings for wear, damage and correct installation and the rear axle end play. CORRECT as necessary. RETEST for normal operation. **No** CORRECT as necessary. RETEST for normal operation.

PINPOINT TEST E: HYDRO-BOOST, NO POWER ASSIST

Test Step	Result / Action to Take
E1 CHECK FLUID LEVEL IN POWER STEERING PUMP ● Check fluid level in power steering pump. ● **Is level within specification?**	**Yes** GO to E2 . **No** CHECK for leakage of power steering fluid. ADD fluid as necessary.
E2 CHECK ACCESSORY DRIVE BELT	

• Check accessory drive belt tension and condition. Refer to Section 303-05 . • **Is the accessory drive belt OK?**	**Yes** GO to E3 . **No** INSTALL a new accessory drive belt. REFER to Section 303-05 .
E3 CHECK POWER STEERING HOSES	
• Check power steering pressure hoses, power steering gear pressure hoses and power steering return hose for cracks or leaks. • **Do power steering pressure hose, power steering gear hose and power steering return hose check OK?**	**Yes** GO to E4 . **No** INSTALL new hoses as necessary. REFER to Section 211-00 .
E4 CHECK BRAKE PEDAL LINKAGE	
• Check brake pedal linkage for binding or sticking operation. • **Does pedal linkage check OK?**	**Yes** GO to E5 . **No** INSTALL new pedal linkage as necessary. REFER to Section 206-06 .
E5 CHECK POWER STEERING PUMP SPEED	
• Check engine idle speed against specifications. • **Is engine idle speed OK?**	**Yes** GO to E6 . **No** SET engine idle speed to specification. REFER to Powertrain Control/Emissions Diagnosis (PC/ED) manual.
E6 CHECK FOR PLUGGED RETURN HOSE	
• **NOTE:** The return hose from the oil cooler to the power steering reservoir has an in-line filter in the hose. • Disconnect power steering return hose from power steering fluid cooler and power steering pump reservoir. • Pass air through hose from the oil cooler end. • **Is hose plugged?**	**Yes** INSTALL a new power steering return hose. **No** GO to E7 .
E7 CHECK POWER STEERING PUMP FLOW AND RELIEF	
• Test power steering pump for correct flow and relief pressure. Refer to Section 211-00 . • **Is power steering pump operating correctly?**	**Yes** INSTALL a new power brake hydro-boost unit. REFER to Section 206-07 . **No** INSTALL a new power steering pump. REFER to Section 211-02 .

PINPOINT TEST F: HYDRO-BOOST ERRATIC OPERATION, STICKS, BINDS OR GRABS

Test Step	Result / Action to Take
F1 CHECK SUPPLY HOSE	
• Check for obstructions in power steering return hose and	**Yes**

connections between the power steering pump reservoir and between the power steering pump reservoir and the hydro-boost power brake booster. ● **Are there any obstructions?**	REMOVE obstructions or INSTALL a new hose. **No** GO to F2 .
F2 CHECK BOOSTER OPERATION	
● Have an assistant check the fluid in the power steering pump reservoir while rapidly applying the brake pedal approximately one inch. ● **Does the fluid show any movement or spouting?**	**Yes** System OK. **No** INSTALL a new hydro-boost assembly.

PINPOINT TEST G: HYDRO-BOOST BRAKE SYSTEM OPERATION SUSPECT

Test Step	Result / Action to Take
G1 CHECK BASIC OPERATION	
● Key in OFF position. ● Press and release brake pedal several times to deplete all hydraulic pressure from the hydro-boost power brake booster. ● Press and hold brake pedal with light pressure. ● Key in START position. ● **Does the brake pedal fall slightly and hold, and is less pressure now required to hold brake pedal at the new position?**	**Yes** Hydro-boost is OK. **No** GO to G2 .
G2 CHECK FOR HYDRAULIC BRAKE LEAK	
● With engine running, press and release brake pedal several times. ● Hold brake pedal down with medium pressure, 34-47 Nm (25-35 lb-ft). ● **Does brake pedal move toward floor?**	**Yes** GO to G3 . **No** GO to G4 .
G3 CHECK FOR LEAKS — BRAKE FLUID LINES	
● Check for leaks at brake lines, including brake master cylinder and brake hose. ● **Do components check OK?**	**Yes** COMPLETE master cylinder By-Pass Condition Test in this section. **No** INSTALL new hoses and lines as necessary.
G4 CHECK HYDRO-BOOST CONNECTIONS	
● Clean the hydro-boost power brake booster, power steering pressure hose, power steering gear pressure hose and power steering return hose and connection. ● Start engine and run at idle. ● Check hose connections for leakage. ● **Do hose connections check OK?**	**Yes** GO to G5 . **No** REPAIR or INSTALL new hose and connections as necessary.
G5 CHECK FOR HYDRO-BOOST LEAK	

• Engine running at idle speed. • **CAUTION: Do not hold the brake pedal at 444 Nm (100 lb) force for more than 5 seconds at a time.** • Apply brake pedal with approximately 444 Nm (100 lb) force and hold. • Check hydro-boost unit input seal, housing seal, accumulator seal, piston seal and spool plug seal for leakage. • **Is hydro-boost unit free of leaks?**	**Yes** GO to G6 . **No** INSTALL a new hydro-boost unit.
G6 CHECK RESERVE RETENTION	
• Engine running at idle speed. • **CAUTION: Do not hold the brake pedal at 444 Nm (100 lb) force for more than 5 seconds at a time.** • Charge system to pressure by holding the steering wheel at stop or by pressing the brake pedal with approximately 444 Nm (100 lb) force. • Key in OFF position. • Wait five seconds. • Press brake pedal and observe if there is any power brake reserve. • **Is there any power brake reserve?**	**Yes** Hydro-boost unit is OK. **No** INSTALL a new hydro-boost unit.

Component Tests

Brake Booster

1. Check the hydraulic brake system for leaks or insufficient fluid.

2. With the transmission (7003) in NEUTRAL, stop the engine (6007) and apply the parking brake control (2780). Apply the brake pedal several times to exhaust all vacuum in the system.

3. Apply the brake pedal and hold it in the applied position. Start the engine. If the vacuum system is operating, the brake pedal will tend to move downward under constant foot pressure. If no motion is felt, the power brake booster system is not functioning. Continue with the following steps.

4. Remove the vacuum booster hose from the check valve connection. Manifold vacuum must be available at the check valve end of the vacuum booster hose with the engine at idle speed and the transmission in NEUTRAL. If the manifold vacuum is available to the power brake booster, connect the vacuum booster hose to the power brake booster check valve and repeat Steps 2 and 3.

5. If no downward movement of the brake pedal is felt, install a new power brake booster.

6. Operate the engine a minimum of 10 seconds at fast idle. Stop the engine, and let the vehicle stand for 10 minutes. Then apply the brake pedal with approximately 89 N (20 lb) of force. The brake pedal feel should be the same as that noted with the engine operating. If the brake pedal feels hard (no power assist), install a new power brake booster check valve and retest. If the brake pedal feels spongy, bleed the hydraulic system to remove air. For additional information, refer to Bleeding — System in this section.

Check Valve

The function of the power brake booster check valve is to allow manifold vacuum to enter the power brake booster and prevent the escape of vacuum in case manifold vacuum is lost during sustained full throttle operation.

To test the function of the power brake booster check valve :

- Start and run the engine for at least 10 seconds.
- Operate the brake pedal to check for power assist.
- Disconnect the vacuum booster hose from the power brake booster check valve. Do not remove the power brake booster check valve from the power brake booster.
- There should be enough vacuum retained in the brake booster for at least one more power-assisted brake operation.

Brake Master Cylinder — Normal Conditions

The following conditions are considered normal and are not indications that the brake master cylinder is in need of service.

Condition 1: During normal operation of the brake master cylinder, the fluid level in the brake master cylinder reservoir will rise during brake application and fall during release. The net fluid level (i.e., after brake application and release) will remain unchanged.

Condition 2: A trace of brake fluid will exist on the booster shell below the master cylinder mounting flange. This results from the normal lubricating action of the master cylinder bore and seal.

Condition 3: Fluid level will decrease with pad wear.

Brake Master Cylinder — Abnormal Conditions

Changes in brake pedal feel or travel are indicators that something could be wrong in the brake system. GO to Symptom Chart for abnormal condition diagnosis.

Bypass Condition Test

1. Disconnect the brake lines at the brake master cylinder.
2. Plug the outlet ports of the brake master cylinder.
3. Apply the brakes. If brake pedal height cannot be maintained, the brake master cylinder has an internal leak and must be rebuilt or replaced.

Compensator Port Check

The purpose of the compensator ports in the brake master cylinder is to supply any additional brake fluid required by the system due to brake pad wear and to allow brake fluid returning from the brake lines to the brake master cylinder to enter the brake master cylinder reservoir.

The returning brake fluid will cause a slight turbulence in the brake master cylinder reservoir.

Turbulence seen in the brake master cylinder reservoir upon application or release of the brake pedal is normal and shows that the compensating ports are not plugged.

Bleeding —Components

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
ST1270-A	NGS Flash Cable 418-F120 (007-00531) or Equivalent

Master Cylinder Priming — In-Vehicle or Bench

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

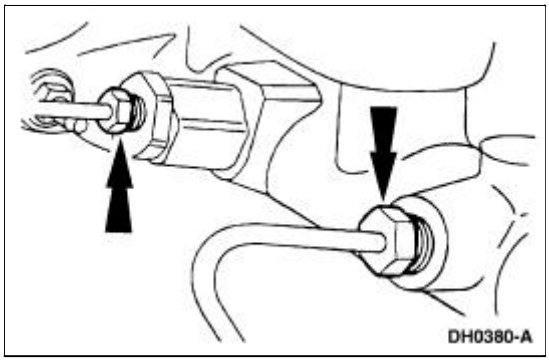
CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

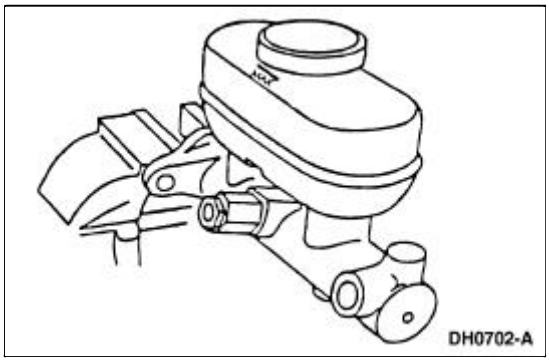
NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can enter the system and cause spongy brake pedal (2455) action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

NOTE: When a new brake master cylinder (2140) has been installed or the system has been emptied, or partially emptied, it should be primed to prevent air from entering the system.

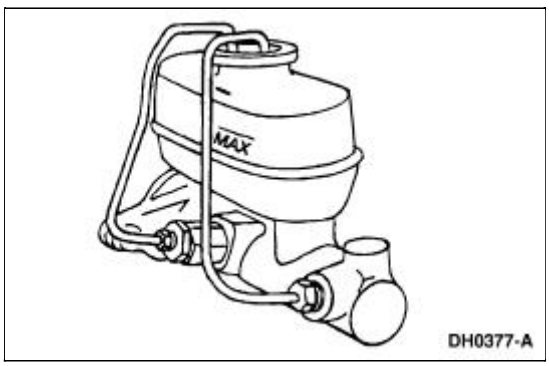
1. For in-vehicle priming, disconnect the brake lines.



2. For bench priming, mount the brake master cylinder (2140) in a vise.



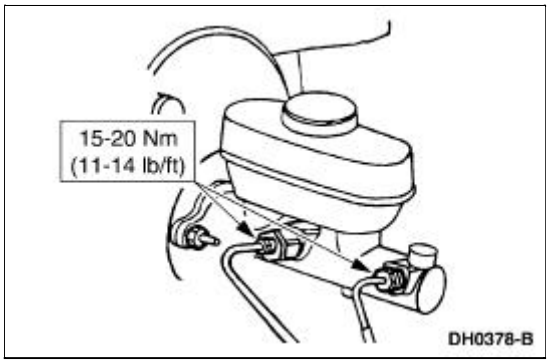
3. Install short brake tubes with the ends submerged in the brake master cylinder reservoir (2K478), and fill the brake master cylinder reservoir with High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A.



4. Have an assistant pump the brake pedal (2455), or slowly depress the primary piston until clear fluid flows from both brake tubes, without air bubbles.

5. If the brake master cylinder has been primed at the bench, install it in the vehicle. For additional information, refer to Section 206-06 .

6. Remove the short brake tubes, and install the brake outlet tubes.

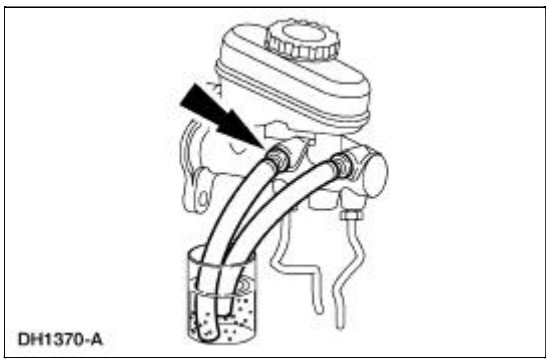


7. Bleed each brake tube at the brake master cylinder as follows:
    1. Have an assistant pump the brake pedal, and then hold firm pressure on the brake pedal.
    2. Loosen the rear most brake tube fittings until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the brake tube fitting.
    3. Repeat this operation until clear, bubble-free fluid comes out.
    4. Refill the brake master cylinder reservoir as necessary. Repeat the bleeding operation at the front brake tube.

Master Cylinder Priming — 4.6L

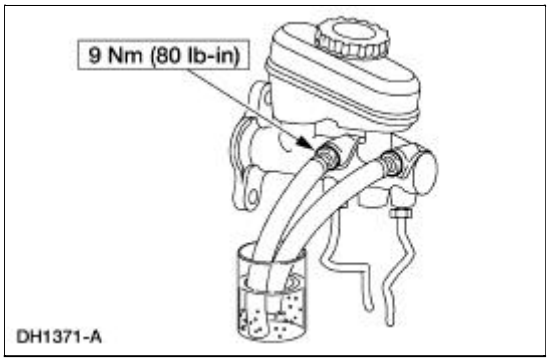
1. **CAUTION: Use only bleed screws on the engine side of the brake master cylinder (2140). The hydro-boost bleed screw, located near the dash on the hydro-booster casting, is for the booster cavity filled with power steering fluid, not brake fluid.**

    Connect a clear waste line to the bleed screw closet to the booster first and the other end in a container partially filled with recommended brake fluid.



2. Open the bleeder screw, have an assistant push the brake pedal down slowly through full travel, close the bleeder screw, then return brake pedal slowly to full released position. Wait five seconds, then repeat operation until air bubbles cease to appear.

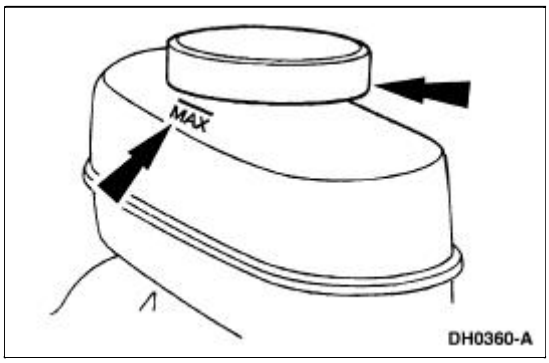
3. Repeat Step 2 for bleeder screw farthest from hydro-booster.



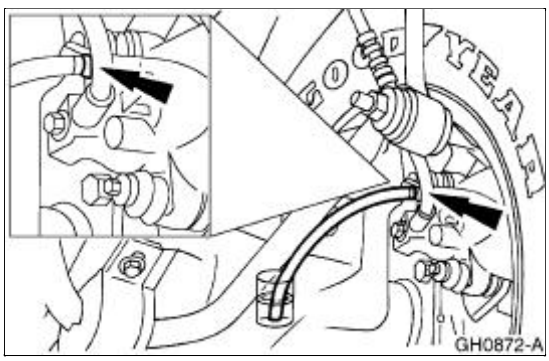
Four Wheel Anti-Lock Brake System (4WABS) Hydraulic Control Unit (HCU)

NOTE: This procedure only needs to be performed if the 4-wheel anti-lock brake (4WABS) hydraulic control unit (HCU) has been installed new or if the HCU lines have been opened.

1. Clean all dirt from and remove the brake master cylinder filler cap (2162), and fill the brake master cylinder reservoir (2K478) with the specified brake fluid.

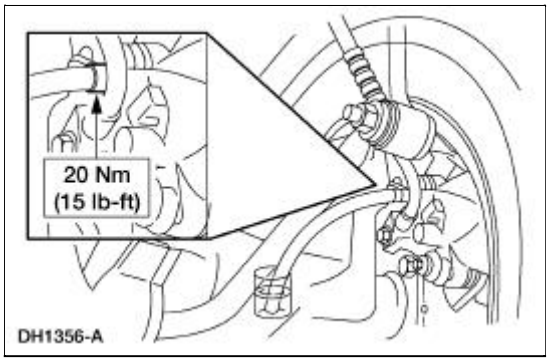


2. Connect a clear waste line to the RH rear bleeder screw (2208) and the other end in a container partially filled with recommended brake fluid.

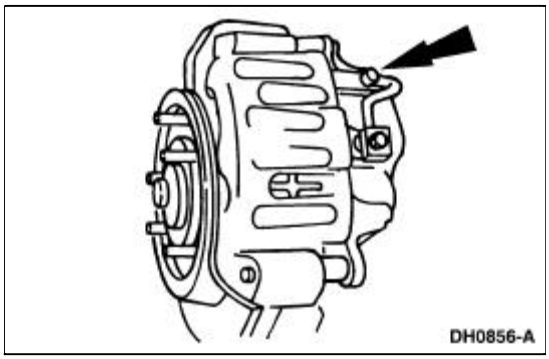


3. Loosen the RH rear bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal (2455), tighten the RH rear bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

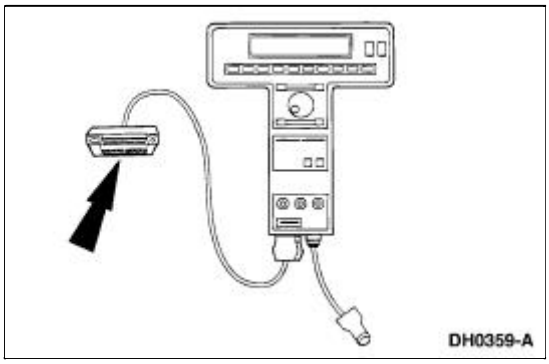
4. Tighten the RH rear bleeder screw, and disconnect the waste line.



5. Repeat Steps 2, 3 and 4 for the LH rear bleeder screw, the RH front disc brake caliper (2B120) bleeder screw, and the LH front disc brake caliper bleeder screw, in that order.



6. Connect the scan tool DCL cable adapter into the vehicle data link connector (DLC) under the dash, and follow the scan tool instructions.

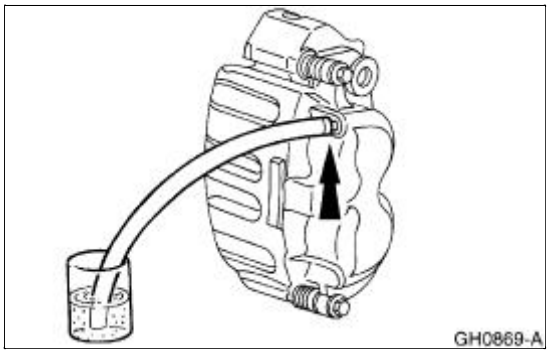


7. Repeat the system bleed procedure as outlined in Steps 1 through 5.

Caliper

1. **NOTE:** It is not necessary to do a complete brake system bleed if only the disc brake caliper (2B120) was disconnected.

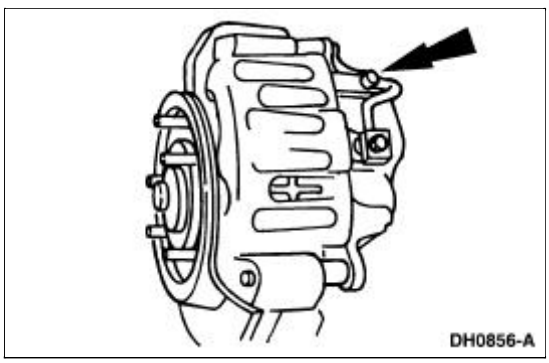
   Place a box end wrench on the disc brake caliper bleeder screw (2208). Attach a rubber drain tube to the disc brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.



2. Have an assistant pump the brake pedal (BP) (2455) and then hold firm pressure on the brake pedal.

3. Loosen the disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the disc brake caliper bleeder screw.
   - Repeat until clear, bubble-free fluid comes out.
   - Refill the brake master cylinder reservoir (2K478) as necessary.

4. Tighten the disc brake caliper bleeder screw. Refer to Specifications.



Bleeding —System

Manual

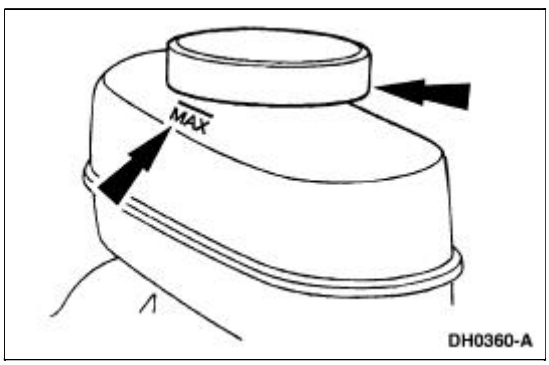
WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

CAUTION: Do not allow the brake master cylinder reservoir to run dry during the bleeding operation. Keep the brake master cylinder reservoir filled with the specified brake fluid. Never reuse the brake fluid that has been drained from the hydraulic system.

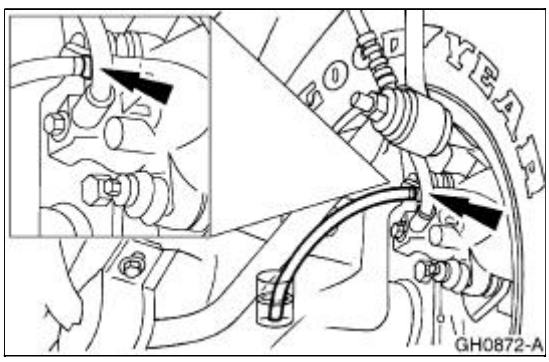
CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

NOTE: When any part of the hydraulic system has been disconnected for repair or installation of new components, air can get into the system and cause spongy brake pedal action. This requires bleeding of the hydraulic system after it has been correctly connected. The hydraulic system can be bled manually or with pressure bleeding equipment.

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with the specified brake fluid.



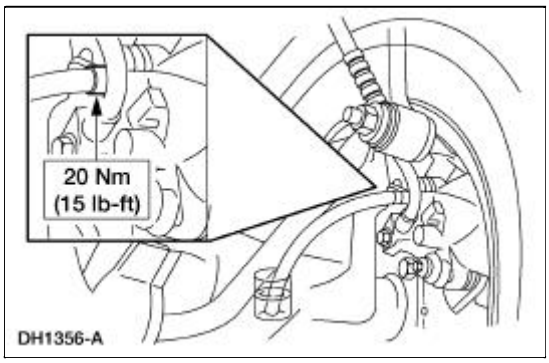
2. Place a box end wrench on the RH rear bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw and submerge the free end of the tube in a container partially filled with clean brake fluid.



3. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.

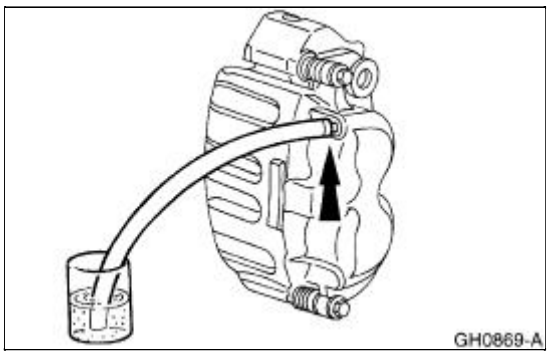
4. Loosen the RH rear bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH rear bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

5. Tighten the RH rear bleeder screw.



6. Repeat Steps 2, 3, 4 and 5 for the LH rear bleeder screw.

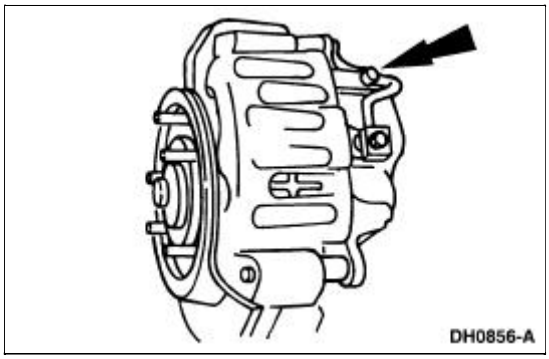
7. Place a box end wrench on the RH front disc brake caliper bleeder screw. Attach a rubber drain tube to the RH front disc brake caliper bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.



8. Have an assistant pump the brake pedal and then hold firm pressure on the brake pedal.

9. Loosen the RH front disc brake caliper bleeder screw until a stream of brake fluid comes out. While the assistant maintains pressure on the brake pedal, tighten the RH front disc brake caliper bleeder screw.
    - Repeat until clear, bubble-free fluid comes out.
    - Refill the brake master cylinder reservoir as necessary.

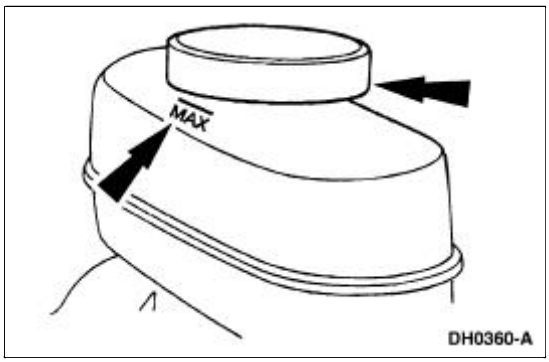
10. Tighten the RH front disc brake caliper bleeder screw. For additional information, refer to Specifications in this section.



11. Repeat Steps 7, 8, 9 and 10 for the LH front disc brake caliper bleeder screw.

Pressure

1. Clean all dirt from and remove the brake master cylinder filler cap and fill the brake master cylinder reservoir with the specified brake fluid.

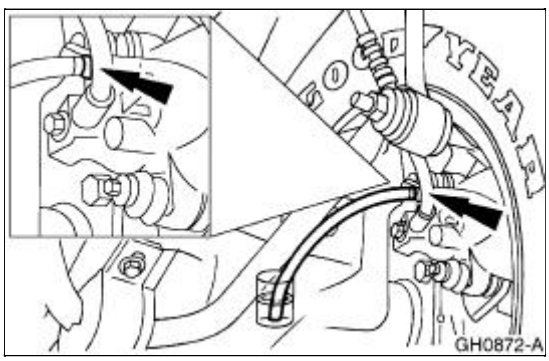


2. **NOTE:** Master cylinder pressure bleeder adapter tools are available from various manufacturers of pressure bleeding equipment. Follow the instructions of the manufacturer when installing the adapter.

   Install the bleeder adapter to the brake master cylinder reservoir, and attach the bleeder tank hose to the fitting on the adapter.

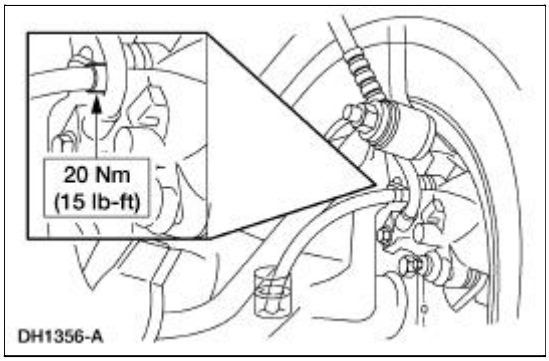
3. **NOTE:** Bleed the longest line first. Make sure the bleeder tank contains enough specified brake fluid to complete the bleeding operation.

   Place a box end wrench on the RH rear bleeder screw. Attach a rubber drain tube to the RH rear bleeder screw, and submerge the free end of the tube in a container partially filled with clean brake fluid.



4. Open the valve on the bleeder tank.

5. Loosen the RH rear bleeder screw. Leave open until clear, bubble-free brake fluid flows, then tighten the RH rear bleeder screw and remove the rubber hose.



6. Continue bleeding the rear of the system, going in order from the LH rear bleeder screw to the RH front disc brake caliper bleeder screw ending with the LH front disc brake caliper bleeder screw.

7. Close the bleeder tank valve. Remove the tank hose from the adapter, and remove the adapter.

Hydraulic Leak Check

1. **NOTE:** Brake fluid is water soluble and it is possible that all evidence of fluid leakage has been washed off if the vehicle has been operated in the rain or snow.

   Make sure the brake master cylinder reservoir (2K478) is full.

2. Apply the brakes several times and make sure the brake pedal (2455) feel is not spongy. If necessary, bleed the system. For additional information, refer to Bleeding—System in this section.

3. If the reservoir level is dropping, inspect the brake components, fittings and lines to locate the source of the leak.

Runout Check —Brake Disc and Hub

Special Tool(s)

ST1687-A	Brake Measurement Kit 134-R0199 or equivalent

Material

Item	Specification
High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA	ESE-M12A4-A

CAUTION: The brake disc (1126) runout specification must be met to ensure correct brake performance without roughness complaints.

CAUTION: Do not install brake discs that are less than the minimum thickness specified. Do not machine a brake disc below the minimum thickness specification.

NOTE: When installing brake discs, always align the painted match marks on the brake discs with those on the front hub or rear axle.

NOTE: When installing brake discs, always apply anti-seize lubricant to the brake disc-to-front hub or to the brake disc-to-rear axle mating surfaces.

1. Do not remove the tire and wheel assembly. Tighten the wheel nuts to specification with a torque stick or torque wrench.

2. Raise and support the vehicle.

3. Assemble the Brake Measurement Kit, using the spherical tip extension.

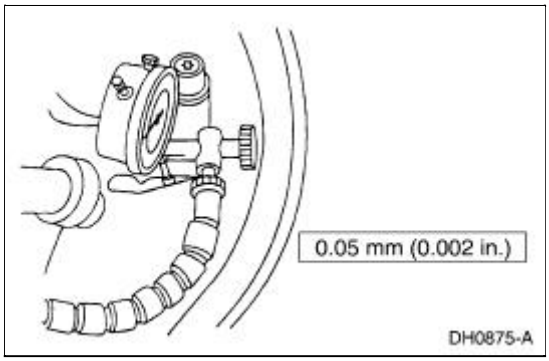
4. Locate an opening on the inboard side of the dust shield that will allow the dial indicator tip to be positioned at least 5 mm (0.2 inch) from the outer edge of the brake disc.

5. **NOTE:** Do not clamp the gauge set to a vehicle component separated from the brake disc by a flexible joint, such as a ball joint or body mount.

   Clamp the Brake Measurement Kit on the vehicle, making sure the flexible indicator arm and probe tip do not touch the dust shield or tire while rotating.

6. **NOTE:** For rear wheel measurement only, have an assistant push in on the wheel cover or axle shaft center while rotating the wheel.

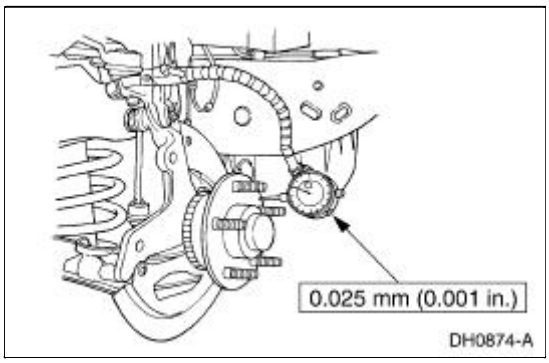
   Rotate the wheel for six revolutions, and record the total indicated runout.



7. If the total indicated runout exceeds the maximum specification, remove the brake disc. For additional information, refer to Section 206-03 for front or to Section 206-04 for rear.

8. Clean the brake disc mounting face of dirt, rust and foreign material.

9. For front wheels, measure and record the total indicated runout of the hub face outside the stud circle.

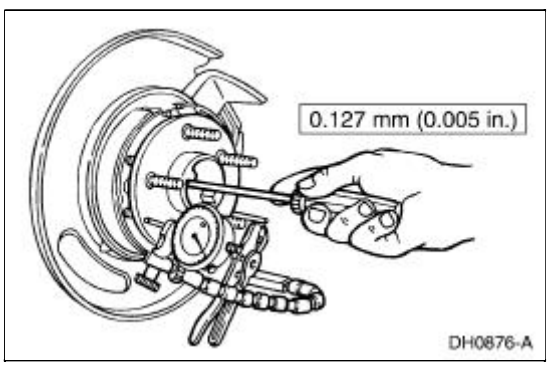


10. Install a new front hub if the total indicated runout exceeds the maximum specification. For additional information, refer to Section 204-01 .
    - Repeat the hub runout measurement.

11. **NOTE:** Clean the axle flange surface before measuring.

    NOTE: For rear wheels, press inward on the axle shaft while measuring the rear axle runout.

    For rear wheels, measure and record the total indicated runout at a point on the axle shaft outside the stud circle.



12. If the total indicated runout exceeds the maximum specification, inspect the rear axle. For additional information, refer to Section 205-00 . Repair as necessary.
    - Repeat the rear brake disc runout measurement.

13. If the brake disc TIR is still out of specification, measure and record the thickness of the brake disc. If thickness is sufficient to machine the brake disc to the runout specification, go to Step 14. If the thickness is not sufficient, install a new brake disc and recheck the TIR.

14. **NOTE:** Brake disc machining must be done with an on-vehicle lathe. Follow the lathe manufacturer's instructions.

    Machine the brake disc if final thickness will not be less than the maximum specification. Recheck the brake disc runout.

General Specifications

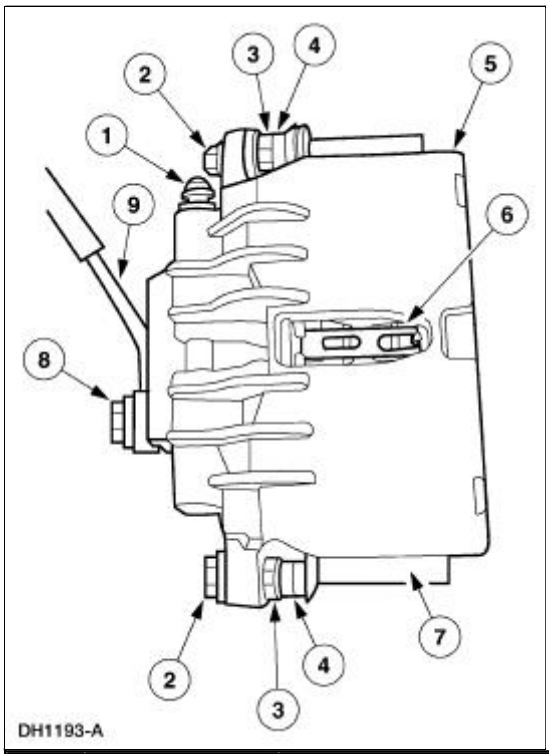
Item	Specification
Disc brake lining wear limit	1.0 mm (0.040 in)
Disc thickness (Mustang/Mustang Cobra)	26 mm (1.02 in)/28 mm (1.10 in)
Disc lateral runout	0.05 mm (0.002 in)
Disc thickness variation	0.009 mm (0.00035 in)
Hub runout	0.025 mm (0.001 in)

Torque Specifications

Description	Nm	lb-ft
Disc brake caliper bolt	31	23
Front brake hose bolt	40	30
Front disc brake caliper anchor plate bolt	115	85
Disc brake caliper bleeder screw	10	7

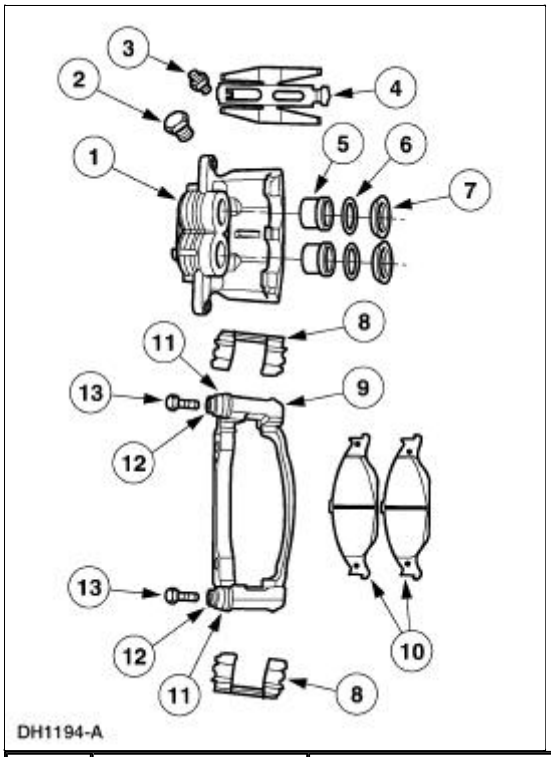
Front Disc Brake

Front Disc Brake Components



Item	Part Number	Description
1	—	Bleeder screw and bleeder screw cap assy
2	2N386	Caliper bolt
3	2B296	Guide pin
4	2A492	Guide pin boot
5	2B120	Disc brake caliper
6	2B164	Anti-rattle spring
7	2B292	Front disc brake caliper anchor plate
8	385116-S2	Flow bolt
9	2078	Front brake hose

Disc Brake Caliper Components



Item	Part Number	Description
1	2B120	Disc brake caliper
2	2L126	Bleeder screw cap
3	2208	Bleeder screw
4	2B164	Anti-rattle spring
5	2196	Caliper piston
6	2B115	Piston seal
7	2207	Piston dust boot
8	2L200	Pad slipper
9	2B292	Front disc brake caliper anchor plate
10	2001	Brake pads
11	2A492	Guide pin boot
12	2B296	Guide pin
13	2N386	Caliper bolt

The front disc brake caliper (2B120):

- bolts to the front disc brake caliper anchor plate (2B292), which bolts to the front wheel spindle (3105).
- is a pin slider, dual piston design.

The front brake discs (1125):

- are of a ventilated full-cast design, with non-directional cooling fins.
- are serviced with the disc brake caliper and front disc brake caliper anchor plate removed.

The front brake disc shield (2K005):

- is riveted to the front wheel spindle.
- protects the front wheel bearings and inboard surface of the front brake disc.

The pads:

- are housed in the front disc brake caliper anchor plate.
- are of a non-asbestos, non-metallic composition.

Pads

Removal

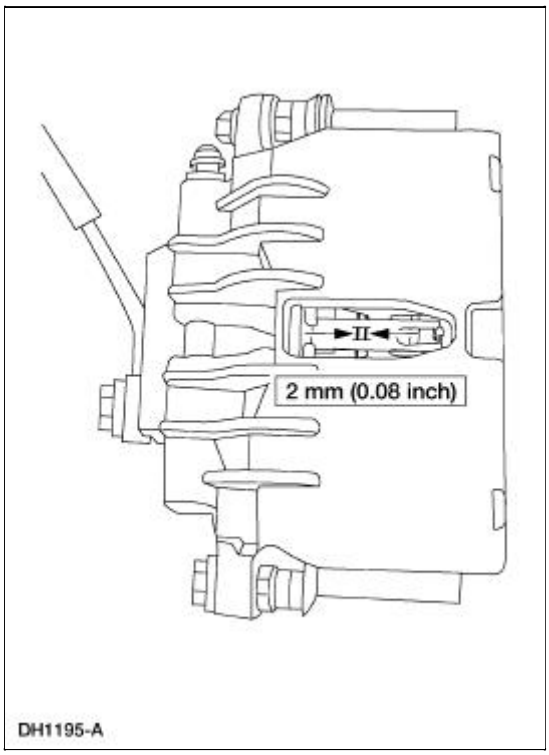
1. Remove brake master cylinder filler cap (2162). Check brake fluid level in brake master cylinder reservoir (2K478). Remove fluid until brake master cylinder reservoir is half full.

2. Raise and support the vehicle. For additional information, refer to Section 100-02 .

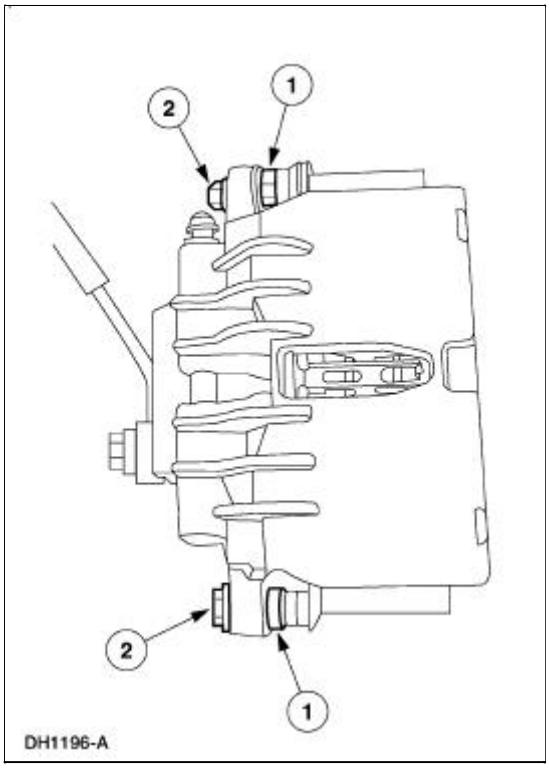
3. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .

4. **CAUTION: Install new pads if worn to or past the specified thickness above the metal backing plate or rivets. Install pads in complete axle sets.**

   Inspect the pads for wear and contamination.



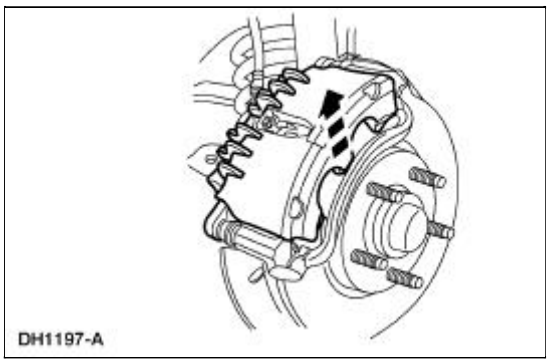
5. Remove the caliper bolts.
   1. Hold the guide pins stationary.
   2. Remove and discard the caliper bolts.



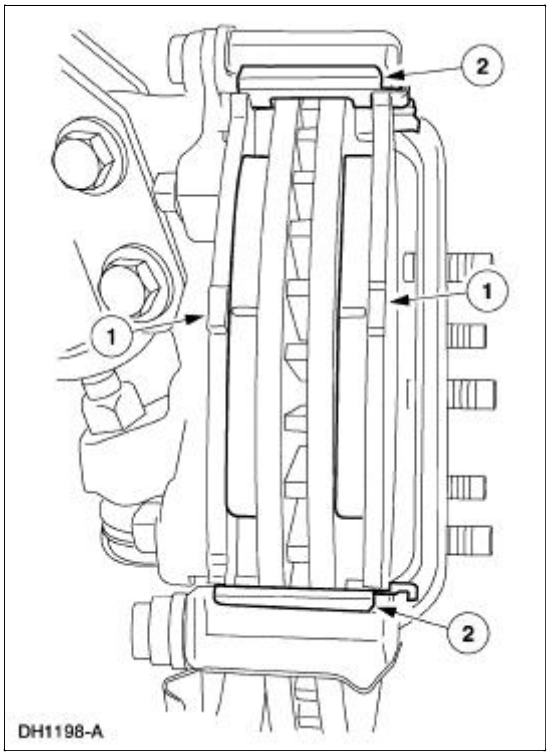
6. **CAUTION: Do not pry in caliper sight hole to retract pistons as this can damage the pistons and boots.**

   CAUTION: When removing the disc brake caliper (2B120), never allow it to hang from the brake hose. Provide a suitable support.

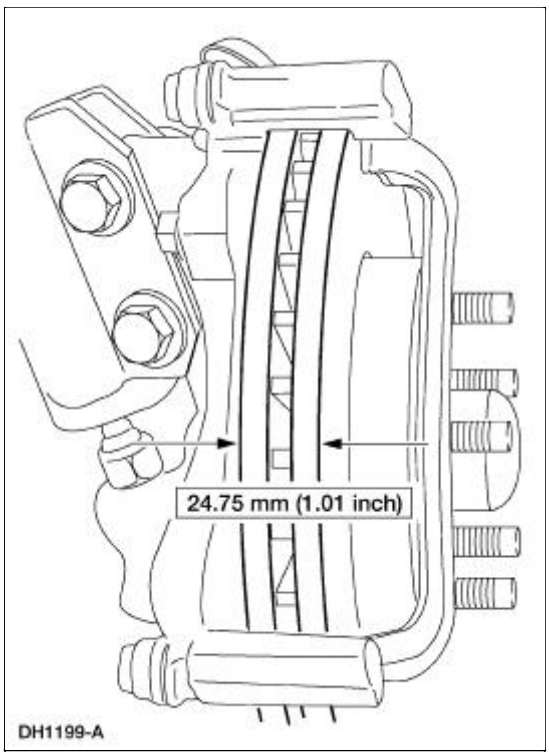
   Lift the caliper off the anchor plate (2B292).



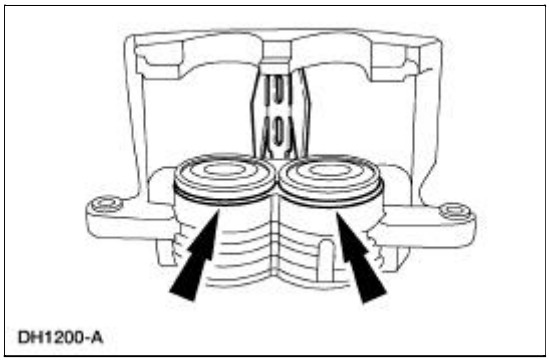
7. Remove the pads and the pad slippers.
   1. Remove the pads and verify thickness.
   2. Remove and discard slippers.



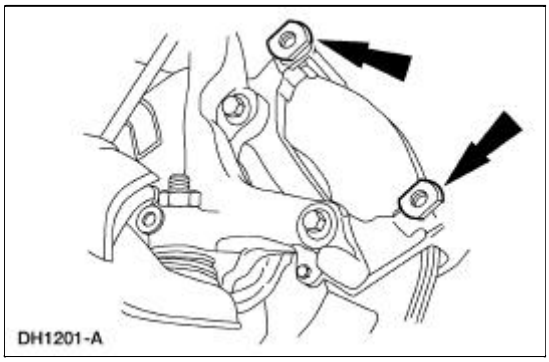
8. Measure the front brake disc thickness.
    - Install a new front brake disc (1125) if not within specification.



9. Inspect the disc brake caliper.
    - If leaks or damaged boots are found, disassembly is required. For additional information, refer to Caliper in this section.



10. Inspect the front disc brake anchor plate assembly.
    - Check the guide pin boots for damage.
    - Check the guide pins for binding and damage.
    - Worn or damaged pins should be installed new.

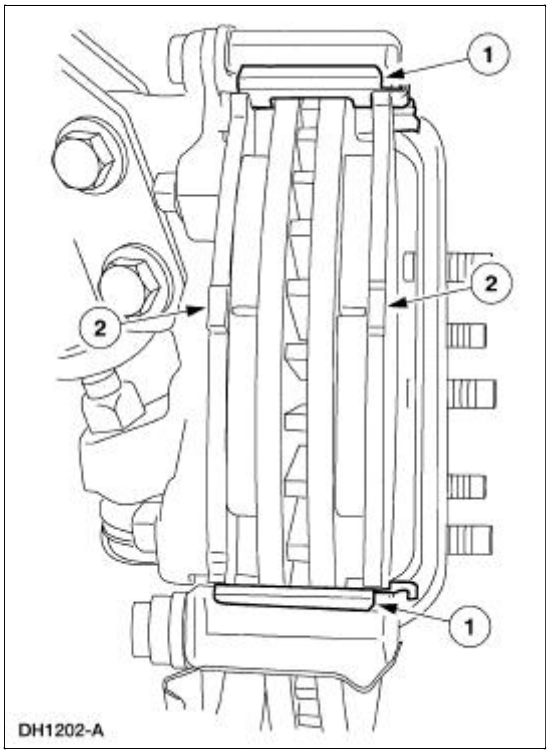


Installation

1. **CAUTION: Do not allow grease, oil, brake fluid or other contaminants to contact the pad lining material. Do not install contaminated pads.**

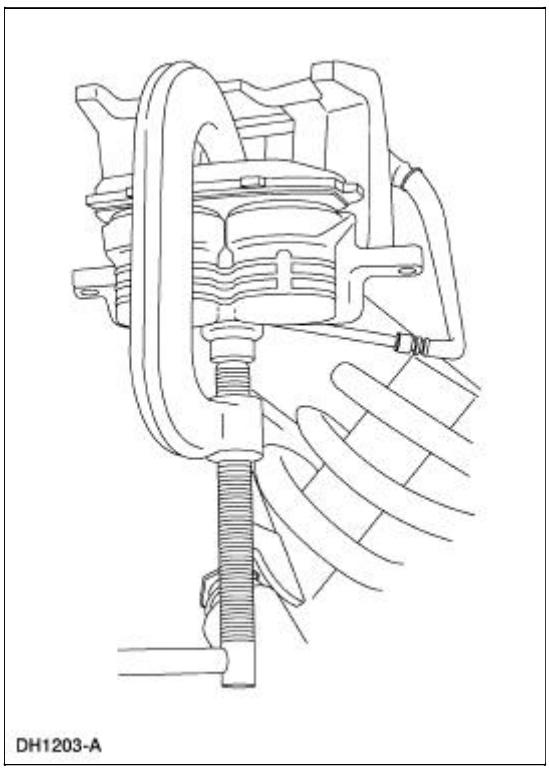
   NOTE: Install all hardware supplied with pad kits.

   Install the pads.
   1. Install the new pad slippers.
   2. Install the pads.

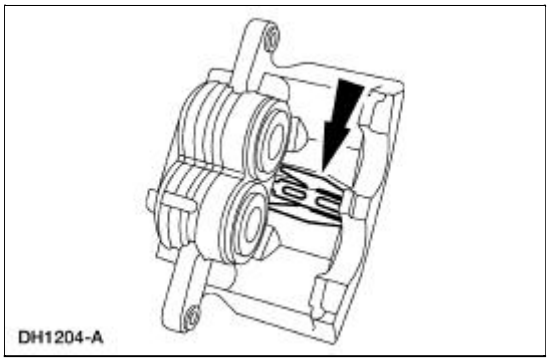


2. **NOTE:** Use a wood block or used pad to protect pistons and boots.

   Compress the caliper pistons (2196).

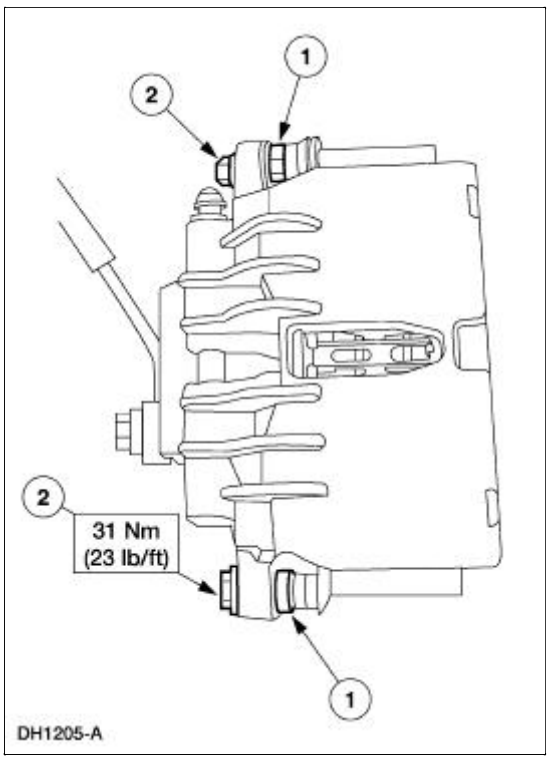


3. Make sure the anti-rattle spring is correctly positioned in the caliper.



4. **CAUTION: Use care not to damage the bleeder screw or front brake disc shield.**

   Install the disc brake caliper.
   1. Hold the guide pins stationary.
   2. Install the caliper bolts.



5. Install the wheel and tire assembly. For additional information, refer to Section 204-04 .

6. Lower the vehicle.

7. Fill the brake master cylinder reservoir with clean High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A. Install brake master cylinder filler cap.

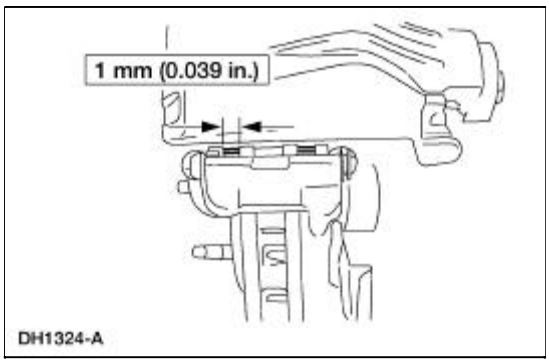
8. Inspect brake operation.

Brake Pads —Cobra

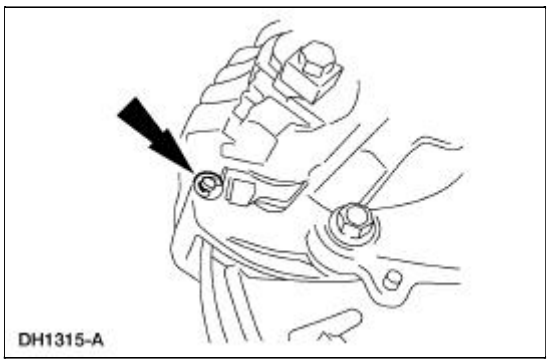
Removal

1. Remove brake fluid in the master cylinder reservoir until the reservoir is half full.
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Remove the tire and wheel assembly. For additional information, refer to Section 204-04 .
4. **CAUTION: Install new pads if worn to or past the specified thickness above the metal backing plate or rivets. Install new pads in complete axle sets.**

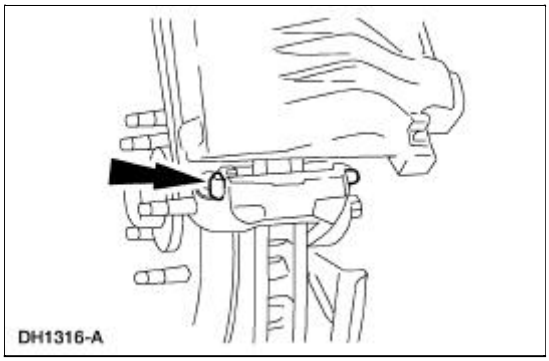
   Inspect the pads for wear and contamination.



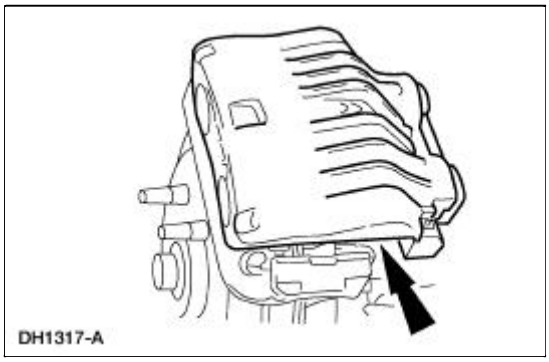
5. Remove the caliper locating pin E-clip.



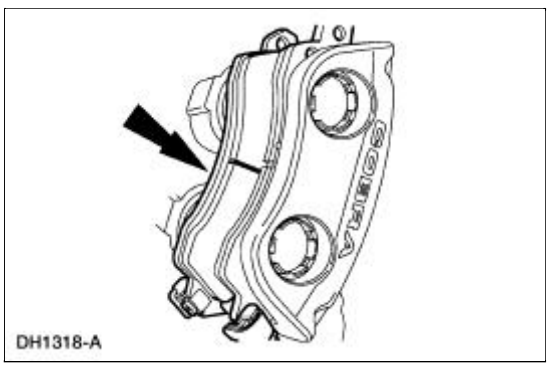
6. Remove the caliper locating pin.



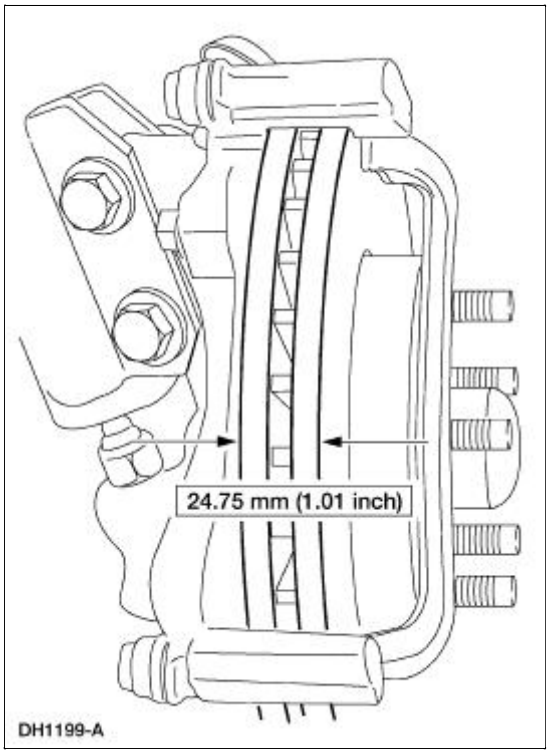
7. Remove the caliper.



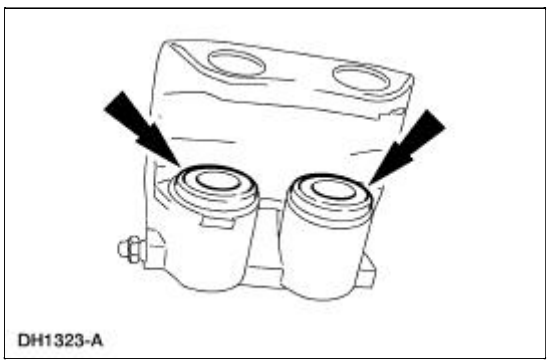
8. Remove the brake pads.



9. Measure the brake disc thickness.
    - Install a new brake disc if not within specification.

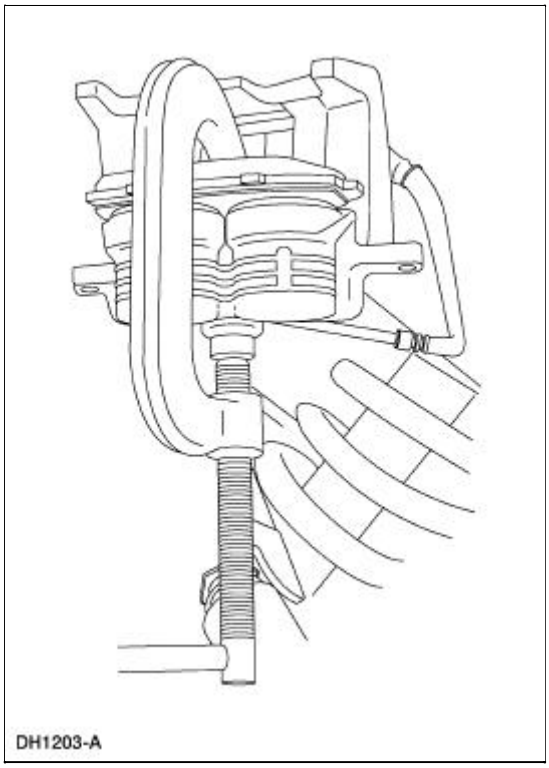


10. Inspect the disc brake caliper.
    - If leaks or damaged boots are found, disassembly is required. For additional information, refer to Caliper in this section.



11. **NOTE:** Use a wood block or used pad to protect pistons and boots.

    Compress the caliper pistons (2196).



Installation

1. Follow the removal procedure in reverse order.

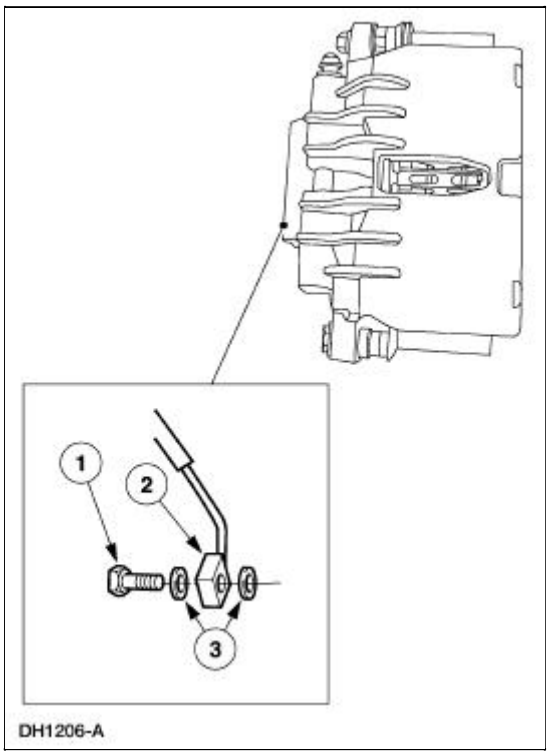
Caliper

Removal

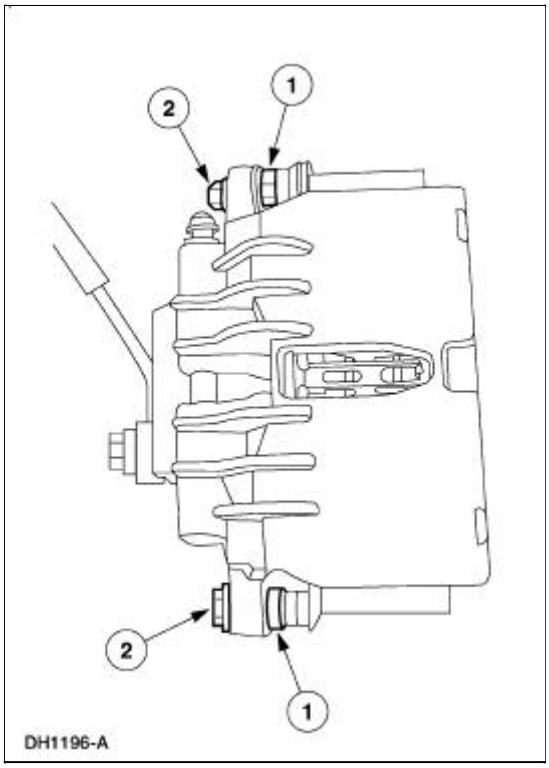
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .
2. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .
3. **WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes, get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.**

   CAUTION: Brake fluid is harmful to painted and plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, wash it with water immediately.

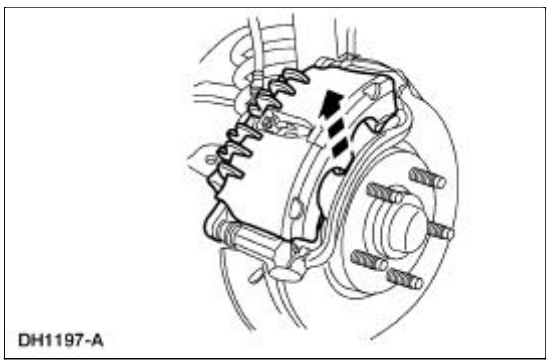
   Disconnect the front brake hose (2078).
   1. Remove the front brake flow bolt.
   2. Disconnect the front brake hose.
   3. Remove and discard the copper washers. Plug the front brake hose.



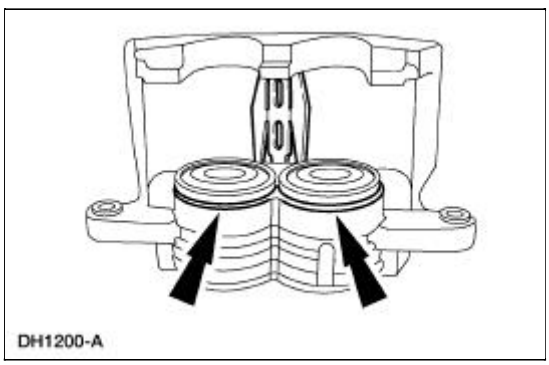
4. Remove the caliper bolts.
   1. Hold the guide pins stationary.
   2. Remove the caliper bolts.



5. Lift the caliper off the anchor plate (2B292).

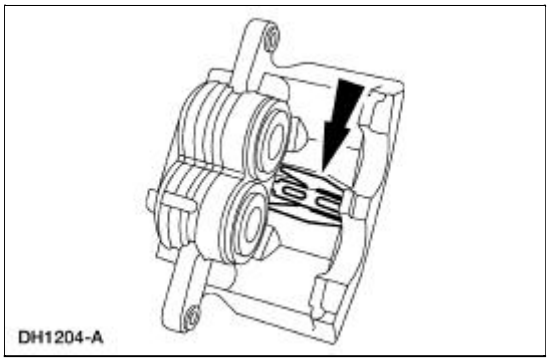


6. Inspect the disc brake caliper.
    - If leaks or damaged boots are found, disassembly is required. For additional information, refer to Caliper in this section.



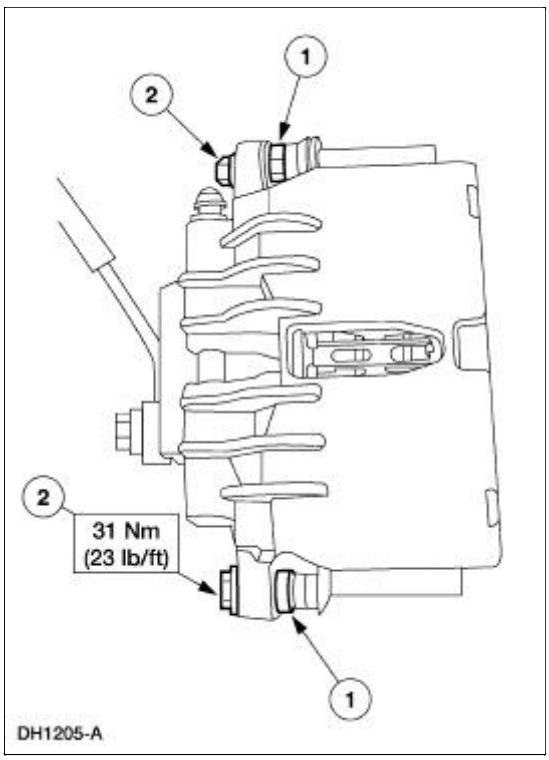
Installation

1. Make sure the anti-rattle spring is correctly positioned in the caliper.



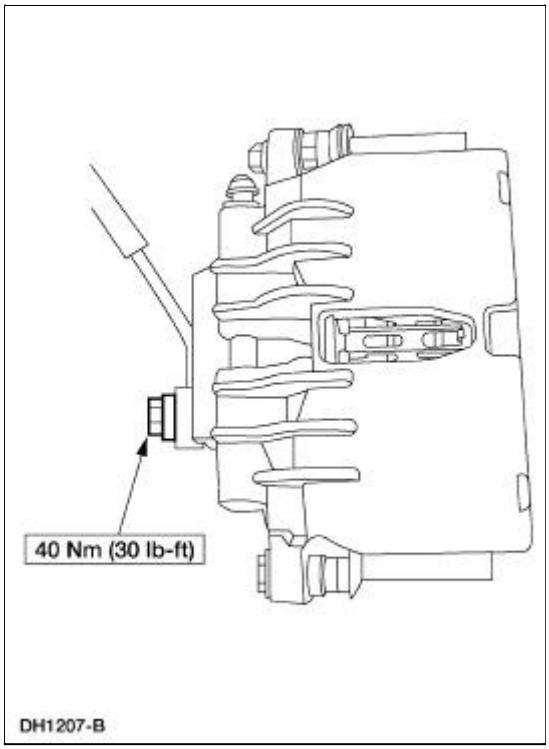
2. **CAUTION: Make sure guide pin boots are correctly seated or damage to guide pins can occur.**

   Install the disc brake caliper.
   1. Hold the guide pins stationary.
   2. Install the caliper bolts.



3. **NOTE:** Use new copper washers.

   Install the front brake hose.

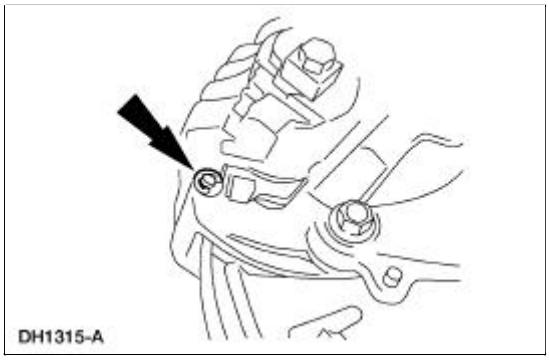


4. Bleed the caliper. For additional information, refer to Section 206-00 .
5. Install the wheel and tire assembly. For additional information, refer to Section 204-04 .
6. Fill the brake master cylinder reservoir (2K478) with clean High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A. Install brake master cylinder filler cap (2162).
7. Check the brake system operation.

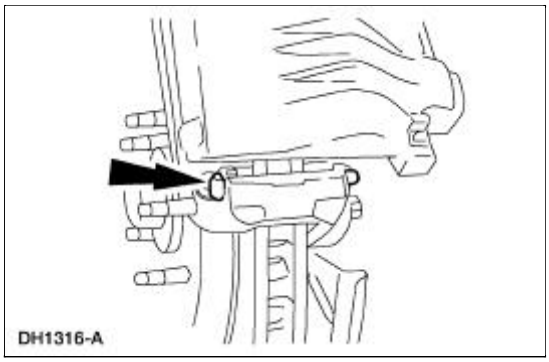
Brake Caliper —Cobra

Removal

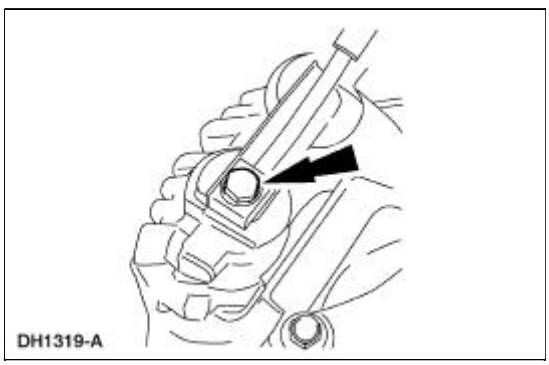
1. Raise and support the vehicle. For additional information, refer to Section 100-02 .
2. Remove the tire and wheel assembly. For additional information, refer to Section 204-04 .
3. Remove the caliper locating pin E-clip.



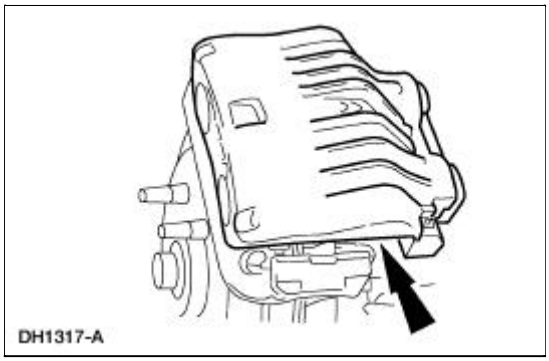
4. Remove the caliper locating pin.



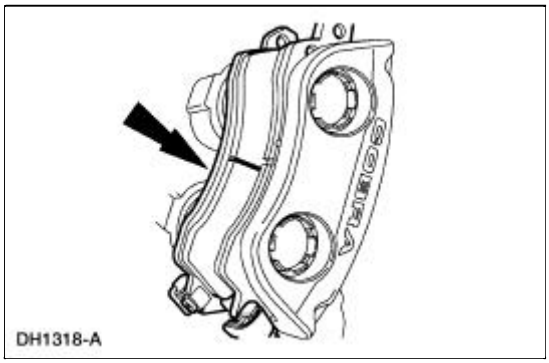
5. Remove the front brake flow bolt.



6. Remove the caliper.



7. Remove the brake pads.

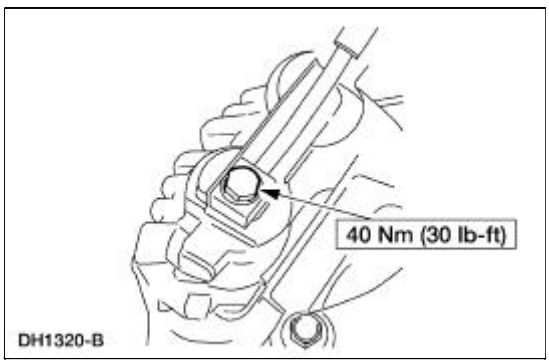


Installation

1. **NOTE:** Use new copper washers on front brake flow bolt.

   Follow the removal procedure in reverse order.

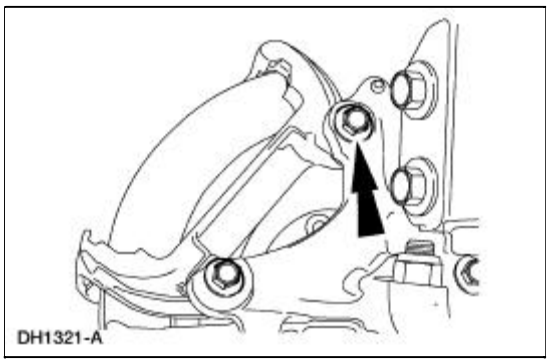
   - Bleed the caliper. For additional information, refer to Section 206-00 .



Brake Caliper Anchor Plate —Cobra

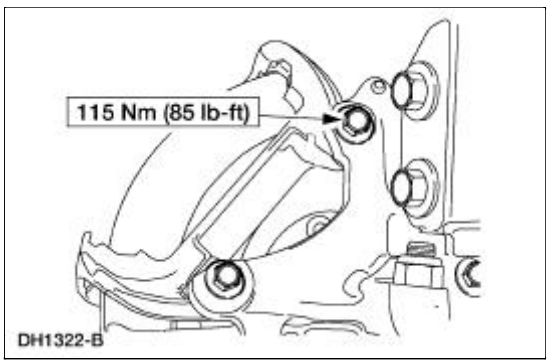
Removal

1. Remove the pads. For additional information, refer to Brake Pads—Cobra in this section.
2. Remove the anchor plate bolts.



Installation

1. Follow the removal procedure in reverse order.

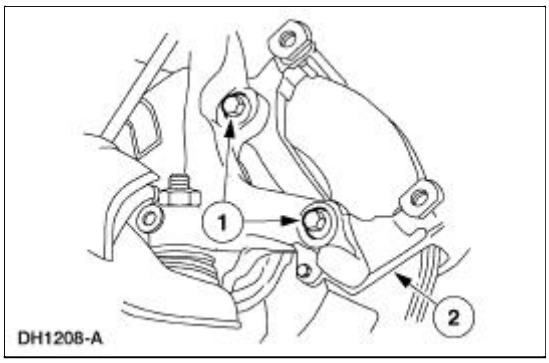


Brake Caliper Anchor Plate

Removal

1. Remove the pads. For additional information, refer to Pads in this section.

2. Remove the anchor plate (2B292).
    1. Remove and discard the anchor plate bolts.
    2. Remove the anchor plate.

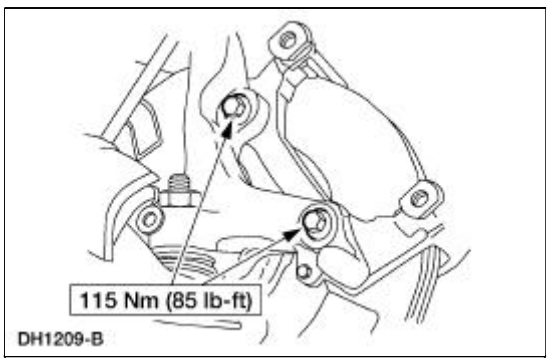


Installation

1. **CAUTION: Use correct type and length bolts.**

   Follow the removal procedure in reverse order.

   - Install new anchor plate bolts.

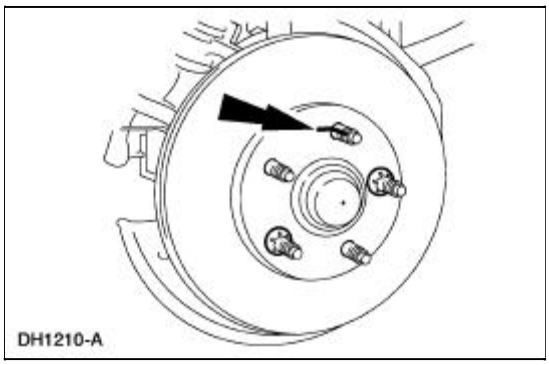


Disc

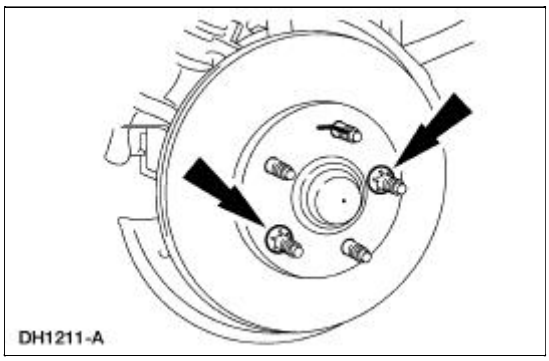
Removal

1. Remove the front disc brake caliper anchor plate (2B292). For additional information, refer to Brake Caliper Anchor Plate in this section.

2. Match mark the hub (1104) and the brake disc (1125).



3. If necessary, remove and discard the keeper nuts.



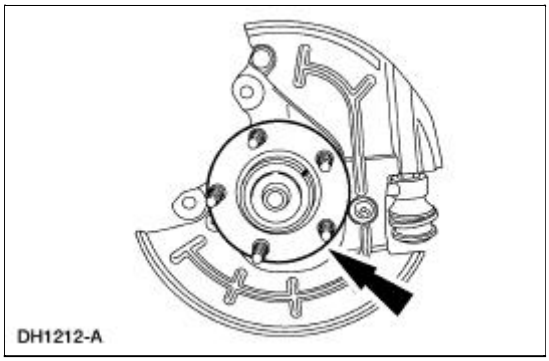
4. **NOTE:** If the brake disc cannot be easily removed, apply Rust Penetrant and Inhibitor F2AZ-19A501-A or equivalent meeting Ford specification ESR-M99C56-A to the mating surfaces.

   Remove the brake disc from the hub.

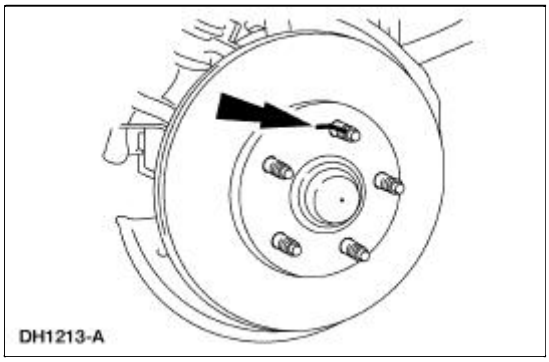
Installation

1. Clean rust and foreign material from the mating surfaces of the hub and brake disc.
   - Use Metal Brake Parts Cleaner F3AZ-19579-SA or equivalent to clean the brake disc and hub.

2. Apply High Temperature Nickel Anti-Seize Lubricant F6AZ-9L494-AA or equivalent meeting Ford specification ESE-M12A4-A to the hub flange.



3. Align the match marks and install the brake disc.



4. Install the anchor plate (2B292). For additional information, refer to Brake Caliper Anchor Plate in this section.

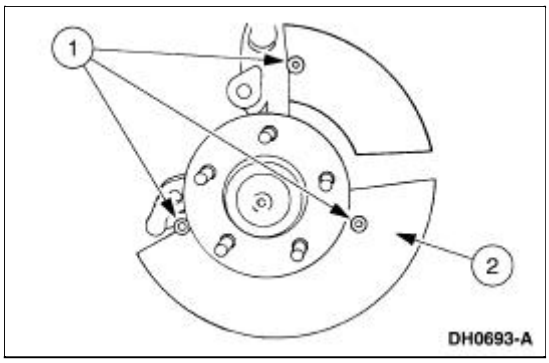
5. Check the total indicated runout (TIR). For additional information, refer to Section 206-00 .

Shield

Removal

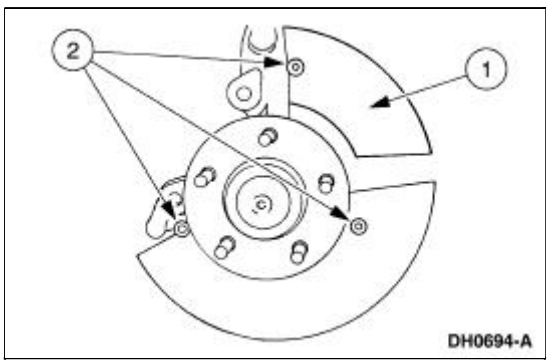
1. Remove the brake disc (1125). For additional information, refer to Disc in this section.

2. Remove the brake disc shield (2K004).
    1. Drill out three brake disc shield rivets.
    2. Remove the brake disc shield.



Installation

1. Install the brake disc shield.
    1. Position the shield.
    2. Secure with three rivets.



2. Install the brake disc. For additional information, refer to Disc in this section.

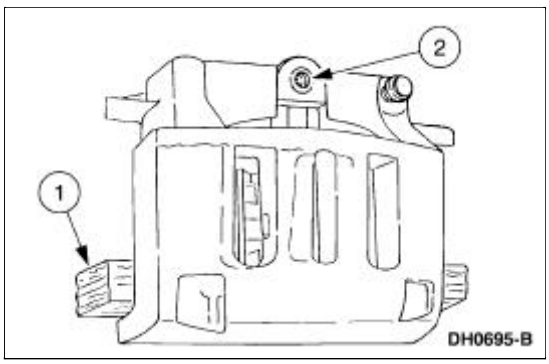
Caliper

Disassembly

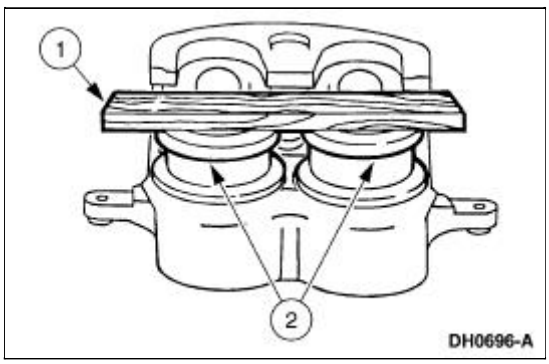
1. Remove the disc brake caliper (2B120). For additional information, refer to Caliper in this section.

2. Drain the remaining brake fluid from disc brake caliper.

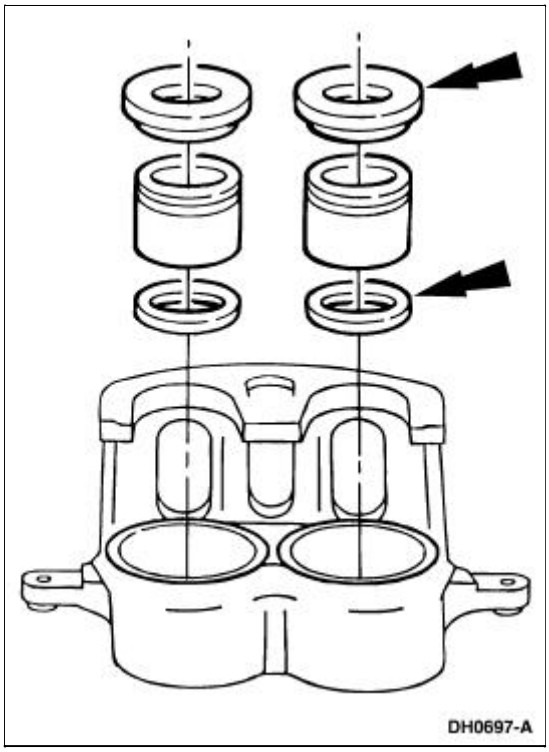
3. Apply low air pressure to the fluid port in the disc brake caliper.
    1. Place a block of wood between the caliper bridge and the caliper pistons (2196).
    2. Apply low air pressure to the fluid port in the disc brake caliper and force out the caliper pistons to the block of wood.



4. Remove the caliper pistons.
    1. Remove the block of wood.
    2. Remove the caliper pistons.



5. Remove and discard the piston seals and boots.



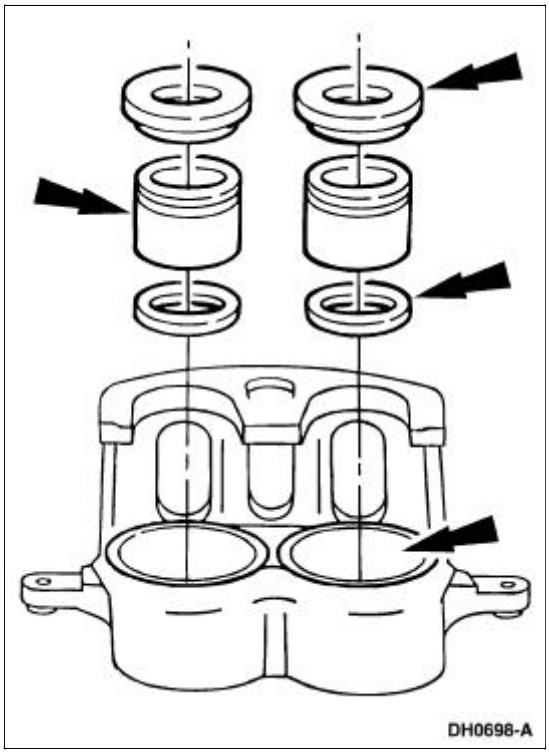
6. Remove and discard the bleed screw and cap.

Assembly

1. **CAUTION: Do not hone the caliper bores. Caliper pistons are not available for honed caliper bores.**

   Clean and inspect the caliper pistons and the disc brake caliper.

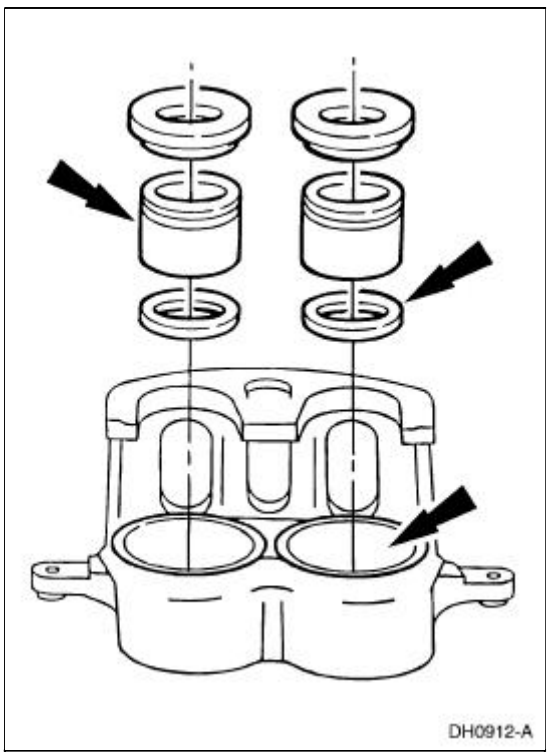
   - Remove dirt and debris.
   - Examine the caliper pistons for surface irregularities, scoring or wear. Damaged caliper pistons should be installed new.
   - Clean the caliper bores with Metal Brake Parts Cleaner F3AZ-19579-SA or equivalent meeting Ford specification.
   - If the caliper bores are corroded or excessively scored, install a new disc brake caliper.
   - Lubricate the caliper pistons and piston seals before assembly.



2. **CAUTION: Never reuse piston seals and dust boots.**

   NOTE: Never reuse brake fluid that has been drained from the hydraulic system or has been allowed to stand in an open container for an extended period of time.

   Lubricate the caliper piston, piston seal and caliper bores with clean High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A.

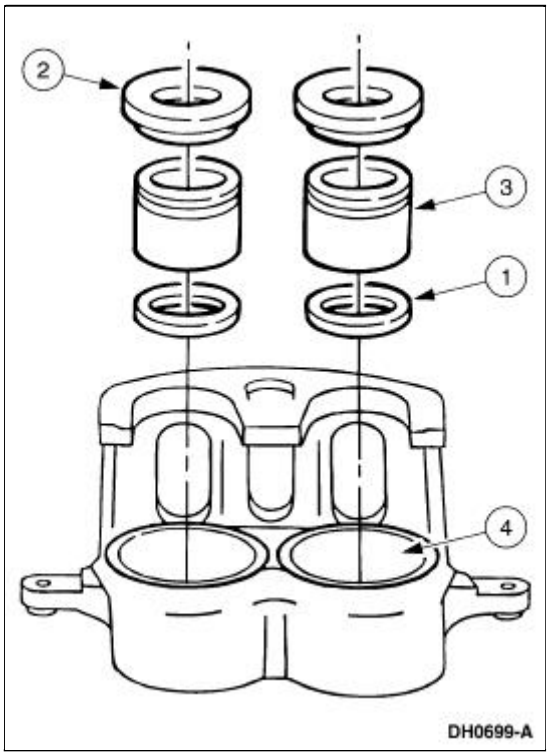


3. Install the caliper piston.

1. Install the piston seal.
2. Install the piston boot on the piston.
3. **CAUTION: Be careful not to damage or dislodge the piston seal.**

   Insert the caliper piston.
4. **CAUTION: Be careful not to cock the caliper piston.**

   Press the caliper piston into the bore.



4. Install a new bleed screw and cap.
5. Install the disc brake caliper. For additional information, refer to Caliper in this section.

General Specifications

Item	Specification
Disc brake lining wear limit	1.0 mm (0.040 in)
Disc thickness	15 mm (0.59 in)
Disc lateral runout	0.102 mm (0.004 in)
Disc thickness variation	0.01 mm (0.0004 in)
Hub runout	—

Torque Specifications

Description	Nm	lb-ft	lb-in
Rear wheel brake hose-to-rear disc brake caliper retaining bolt	40	30	—
Rear disc brake support bracket bolts	103	76	—
Brake disc shield bolts	9-12	—	80-106
Rear brake pin retainer	33	25	—

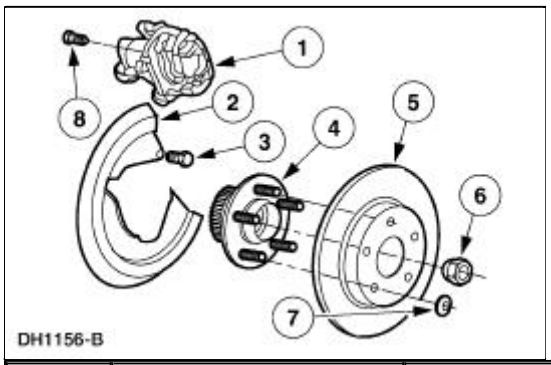
Rear Disc Brake

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

The rear disc brake system consists of:

- solid, full-cast brake disc (2C026).
- hydraulically activated rear disc brake caliper (2552).
- integral mechanically (cable) operated parking brake mechanism that is self-adjusting.

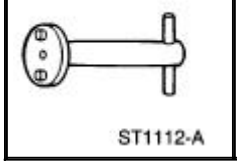
Rear Disc Brake System Components



Item	Part Number	Description
1	2552	Rear disc brake caliper
2	2C028	Brake disc shield
3	N606675-S2	Bolt (3 req'd each side)
4	1104	Wheel hub
5	2C026	Brake disc
6	4B423	Rear wheel hub retainer
7	W623485-S2	Nut (2 req'd each side)
8	N805163-S100	Bolt (4 req'd)

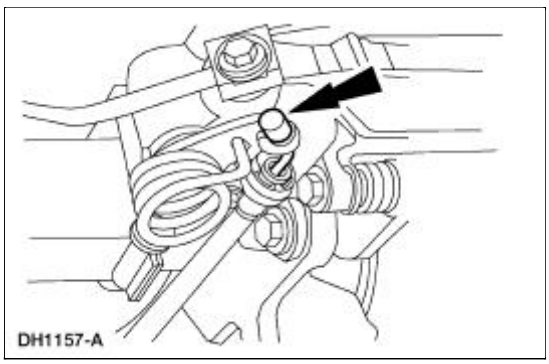
Caliper

Special Tool(s)

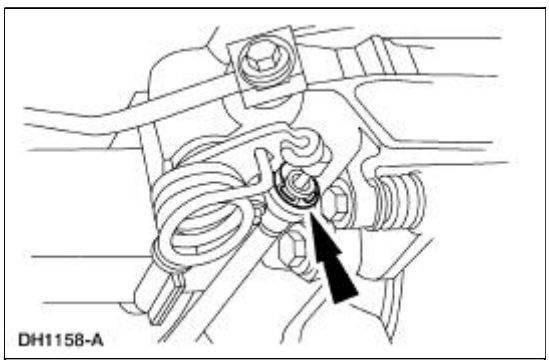
 ST1112-A	Rear Caliper Piston Adjuster 206-026 (T87P-2588-A)

Removal

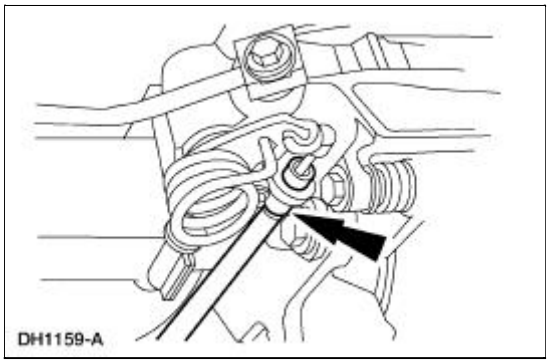
1. Raise the vehicle on a hoist. For additional information, refer to Section 100-02 .
2. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .
3. Disengage the parking brake cable end from the parking brake lever arm.



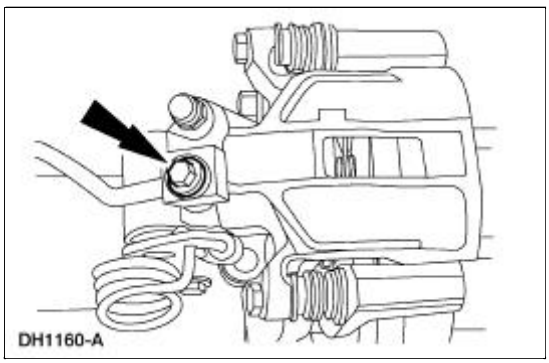
4. Remove the parking brake cable retaining clip.



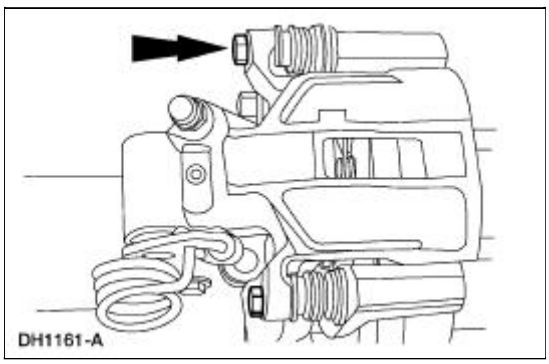
5. Remove the parking brake cable and conduit.



6. Remove the rear disc brake caliper brake hose bolt.



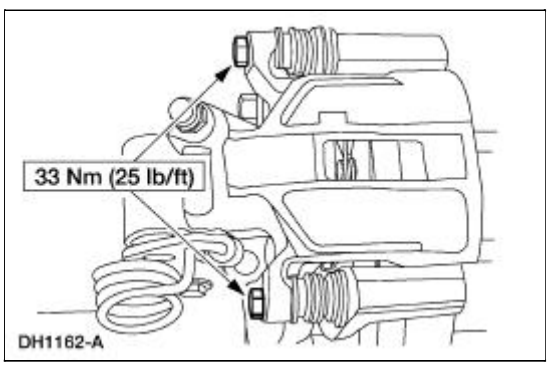
7. Remove the rear brake pin retainers (2N386) and remove the caliper.

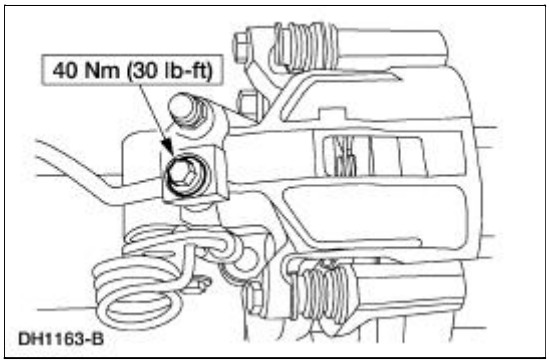


Installation

1. **NOTE:** Use new copper washers.

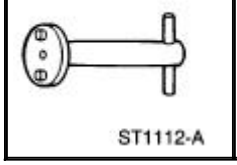
   Follow the removal procedure in reverse order.
   - Bleed the brake system. For additional information, refer to Section 206-00 .




40 Nm (30 lb-ft)
DH1163-B

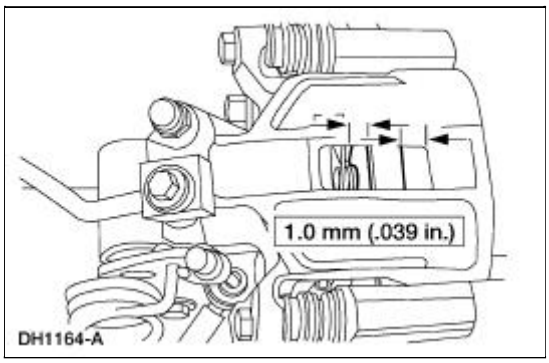
Pads

Special Tool(s)

 ST1112-A	Rear Caliper Piston Adjuster 206-026 (T87P-2588-A)

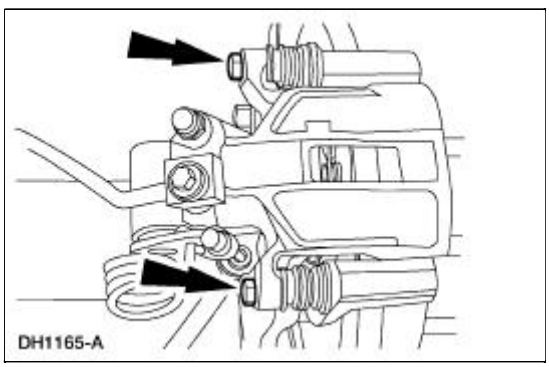
Removal

1. Use a suitable suction device to lower the brake fluid level in the master cylinder reservoir.
2. Raise and support the vehicle. For additional information, refer to Section 100-02 .
3. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .
4. Inspect the pads for wear or contamination, install new if worn to or past specification.

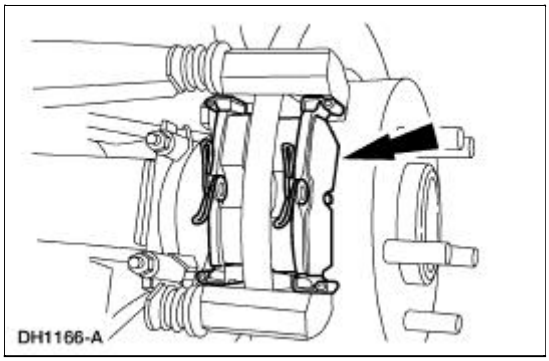


5. **CAUTION: Do not allow the rear disc brake caliper (2552) to hang from the rear wheel brake hose (2A442).**

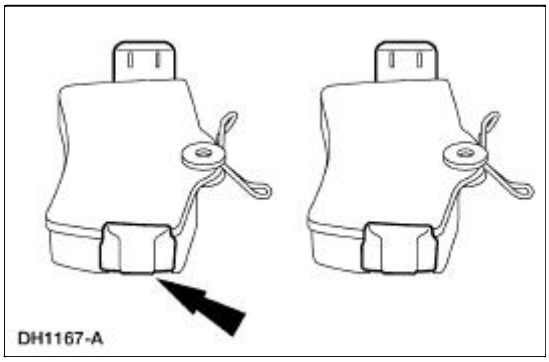
   Remove the rear disc brake caliper bolts and position the caliper aside.



6. Remove the brake pads.

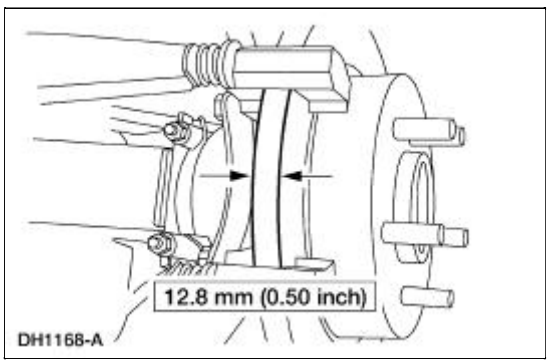


7. Remove the slippers.

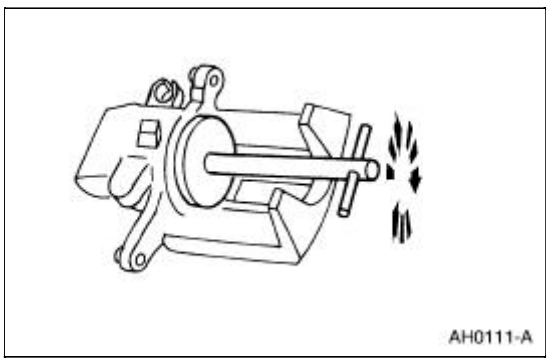


8. **CAUTION: Use a hub-mount brake lathe if necessary to machine the brake disc.**

   Measure the brake disc, resurface and or install new as necessary.



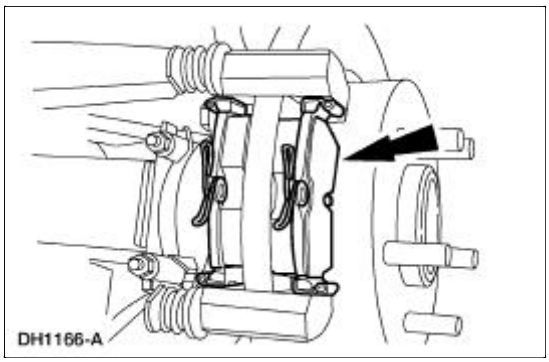
9. Compress the rear disc brake piston and adjuster (2B588) into rear disc brake caliper using Rear Caliper Piston Adjuster.



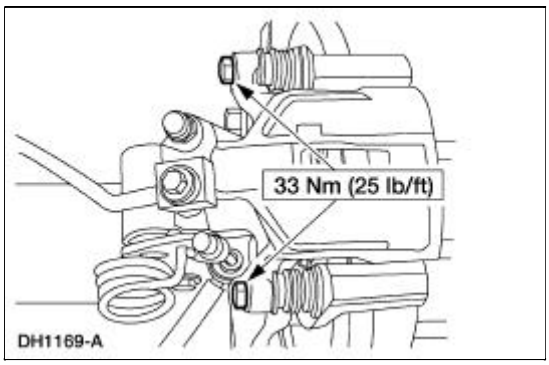
Installation

1. **CAUTION: Install the brake pads in full axle sets. Do not install new brake pads on only one side of vehicle.**

   Install the new slipper and brake pads.



2. Position the caliper on the anchor plate and install the bolts.



3. Install the wheel and tire assembly. For additional information, refer to Section 204-04 .

4. Lower the vehicle.

5. **WARNING: Use of any other than approved DOT 3 or DOT 4 brake fluid will cause permanent damage to components and will render the brakes inoperative.**

   WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

   CAUTION: Brake fluid is harmful to painted or plastic surfaces. If brake fluid is spilled onto a painted or plastic surface, immediately wash it with water.

   Check the fluid level at the master cylinder. Add fluid if necessary.

6. **WARNING: Pump the brake pedal several times to make sure the caliper piston is extended to its operating position. Failure to follow these instructions may result in personal injury.**

   Verify correct brake operation.

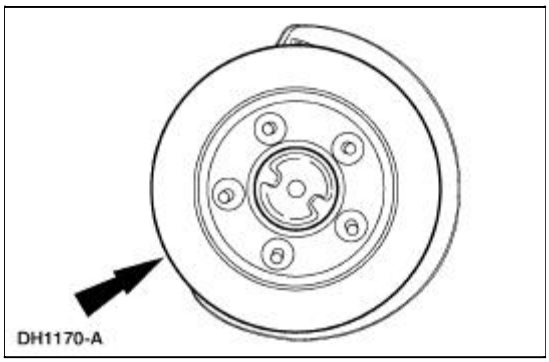
7. Recheck the master cylinder fluid level.

Disc

Removal

1. Remove the rear disc support bracket (2B511). For additional information, refer to Support Bracket in this section.

2. Remove the brake disc (2C026).



Installation

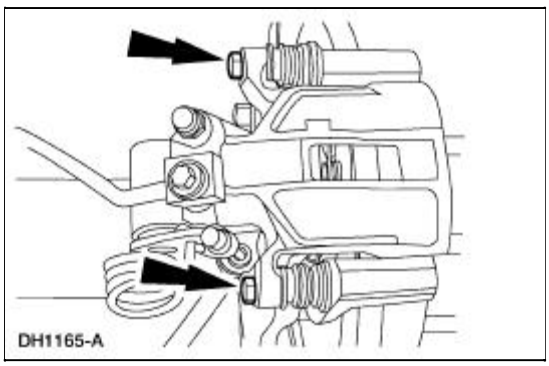
1. Follow the removal procedure in reverse order.

Brake Caliper Support Bracket

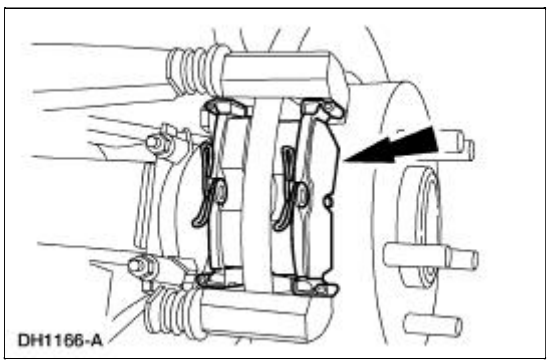
Removal

1. Raise and support the vehicle. For additional information, refer to Section 100-02 .
2. Remove the tire and wheel assembly. For additional information, refer to Section 204-04 .
3. **CAUTION: Do not allow the rear disc brake caliper (2552) to hang from the rear wheel brake hose (2A442)**

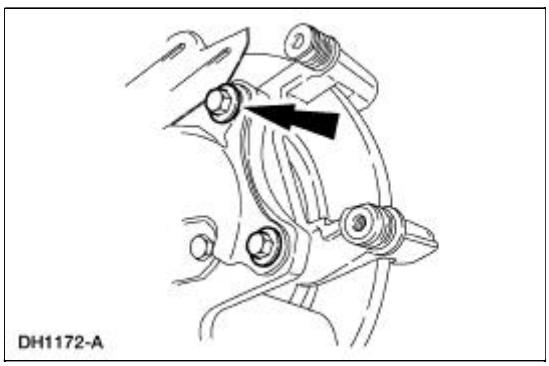
   Remove the rear disc brake caliper bolts and position the caliper aside.



4. Remove the brake pads.



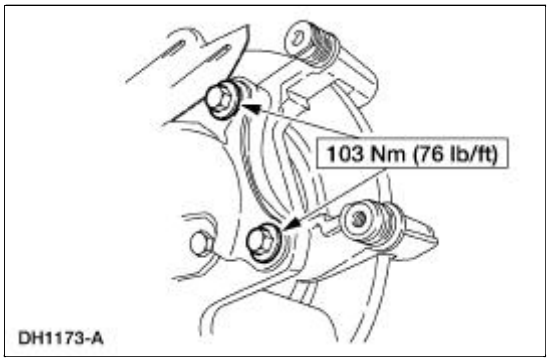
5. Remove the rear disc support bracket (2B511) bolts and bracket.

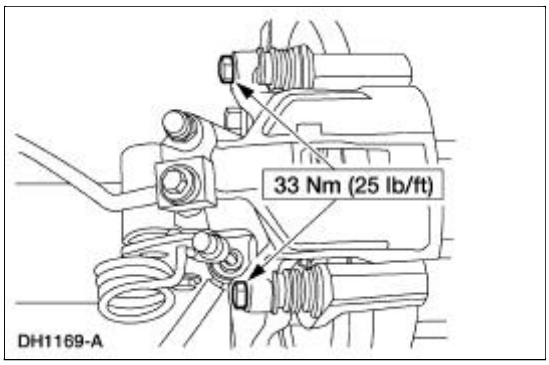


Installation

1. **NOTE:** New bolts must be used when reinstalling the rear disc support bracket.

   Follow the removal procedure in reverse order.

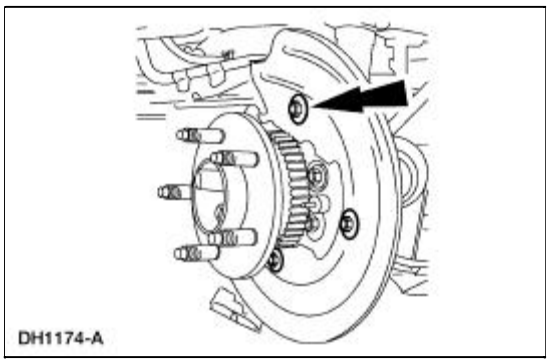




Shield

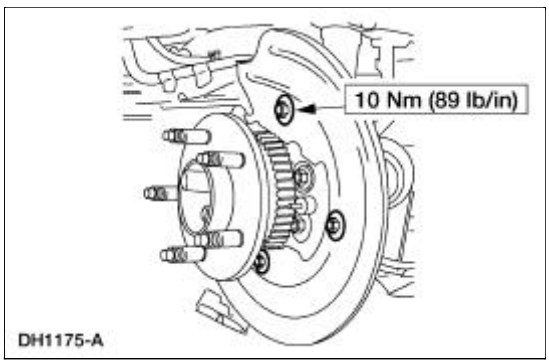
Removal

1. Remove the brake disc (2C026). For additional information, refer to Disc in this section.
2. Remove the brake disc shield bolts.



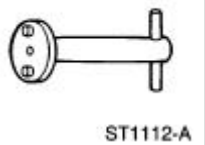
Installation

1. Follow the removal procedure in reverse order.



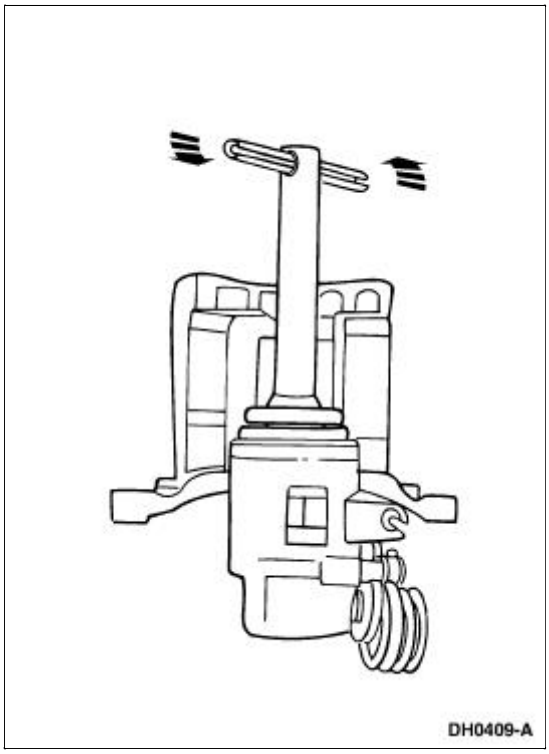
Caliper

Special Tool(s)

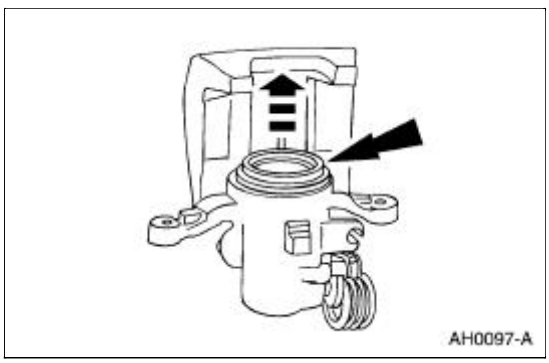
 ST1112-A	Rear Caliper Piston Adjuster 206-026 (T87P-2588-A)
ST1113-A	Rear Caliper Spring Compressor Set 206-S027 (T87P-2588-B)

Disassembly

1. Remove the rear disc brake caliper (2552). For additional information, refer to Caliper in the Removal and Installation portion of this section.
2. Drain the brake fluid from the rear disc brake caliper.
3. Secure the rear disc brake caliper in a vise.
4. Turn the rear disc brake piston and adjuster (2B588) counterclockwise with Rear Caliper Piston Adjuster.



5. Remove the rear disc brake piston and adjuster from the caliper bore.

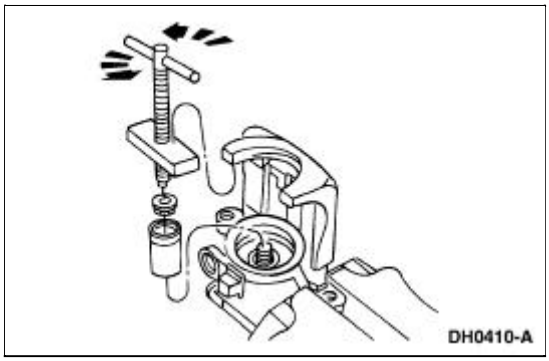


6. Remove and discard the piston dust boot seal and piston seal from the caliper bore.

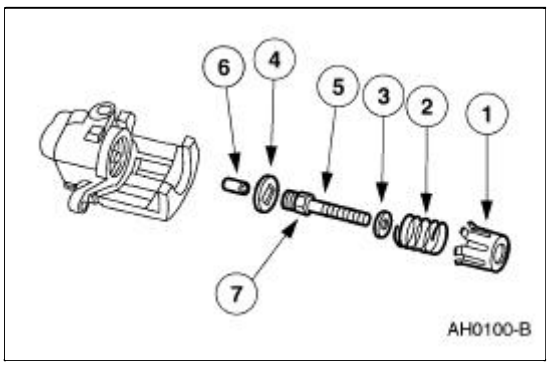
7. **CAUTION: The parking brake lever pin retainer clip (2A746) and spring cover are spring-loaded. Use care when removing the parking brake lever pin retainer clip.**

   Remove the parking brake lever pin retainer clip.

   - Unload the spring tension from the parking brake lever pin retainer clip and spring cover using Screw and Cross Block, a 6-mm washer head nut and a 1/2-inch drive 14-mm socket.
   - Remove the parking brake lever pin retainer clip with suitable snap-ring pliers.
   - Remove Screw and Cross Block.

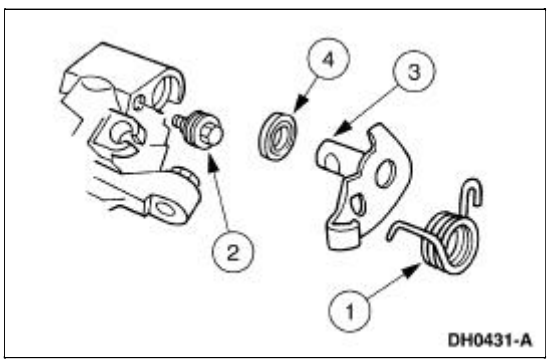


8. Remove the following components:
    1. spring cover
    2. spring
    3. washer
    4. key plate
    5. push rod
    6. strut pin
    7. push rod O-ring



9. Remove and discard the O-ring seal from the push rod.

10. Remove the parking brake lever (2A637).
    1. Remove the parking brake return spring (2456).
    2. Remove the limiting bolt (2A795).
    3. Remove the parking brake lever.
    4. Remove the parking brake lever shaft seal from the caliper bore.



Assembly

1. **CAUTION: Do not reuse piston seals or dust boots. Install new seals or dust boots or damage to the vehicle can occur.**

NOTE: Use new brake fluid when assembling and bleeding the brake system.

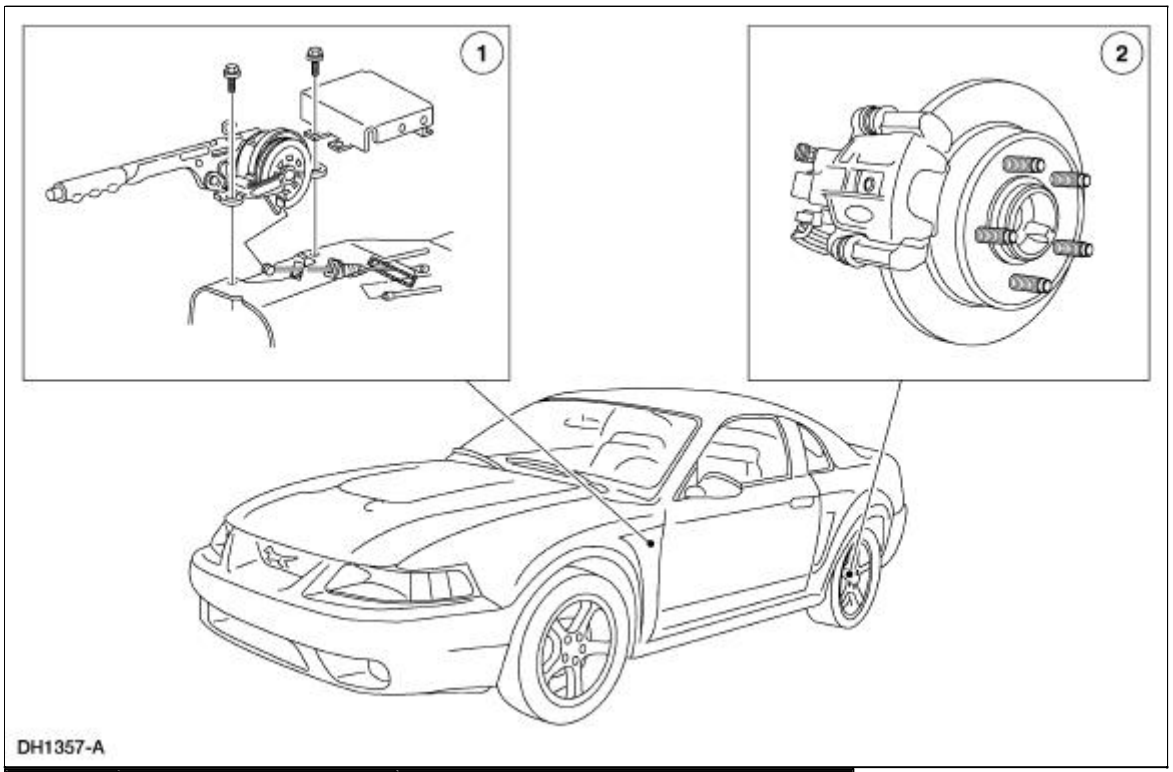
NOTE: Lightly lubricate the parking brake lever bore, limiting bolt, parking brake lever shaft and parking brake shaft recess with Silicone Dielectric Compound D7AZ-19A331-A or equivalent meeting Ford specification ESE-M1C171-A.

Follow the disassembly procedure in reverse order.

Torque Specifications

Description	Nm	Lb/Ft
Parking brake control-to-cowl nut	17	13
Brake hose clip mounting bolt	12	9

Parking Brake



Item	Part Number	Description
1	2780	Parking brake control
2	2552	Rear disc brake caliper

The parking brake system is cable-actuated and controlled by an independent hand-operated parking brake control (2780). To apply parking brake, pull parking brake control upward as far as possible.

The parking brake system is an AUTO-ADJUST system. The spring in the parking brake control continuously adjusts the cable tension in the system.

Brake Warning System

A parking brake warning indicator:

- is located in the instrument panel.
- illuminates to signal the driver the parking brake is applied or to signal a low fluid condition.
- remains lit when a brake malfunction has occurred.

Parking Brake

Inspection and Verification

1. Verify the customer's concern by operating the parking brake system to duplicate the condition.
2. Inspect to determine if one of the following mechanical or electrical concerns apply:

Visual Inspection Chart

Mechanical	Electrical
● Damaged parking brake control ● Binding/damaged parking brake cables	● Parking brake signal switch

3. If the inspection reveals obvious concern(s) that can be readily identified, service as necessary.
4. If concern(s) remains after the inspection, determine the symptoms. GO to Symptom Chart .

Symptom Chart

Symptom Chart

Condition	Possible Sources	Action
● Parking Brake Will Not Apply	● Parking brake control. ● Parking brake cable.	● Go To Pinpoint Test A .
● Parking Brake Will Not Release	● Parking brake cable. ● Parking brake control.	● Go To Pinpoint Test B .

Pinpoint Tests

PINPOINT TEST A: PARKING BRAKE WILL NOT APPLY

Test Step	Result / Action to Take
A1 CHECK THE PARKING BRAKE CABLES	
● Raise and support the vehicle. Refer	**Yes**

to Section 100-02 . ● Inspect for broken or binding parking brake cables or broken guide clips. ● **Is there a parking brake cable concern?**	INSTALL a new parking brake cable as necessary. TEST the system for normal operation. **No** GO to A2 .
A2 CHECK THE PARKING BRAKE CONTROL	
● Operate the parking brake control. ● **Does the parking brake control operate smoothly?**	**Yes** INSTALL a new parking brake lever. RESTORE vehicle and TEST the system for normal operation. **No** REPAIR the binding condition in the parking brake control. TEST the system for normal operation.

PINPOINT TEST B: PARKING BRAKE WILL NOT RELEASE

Test Step	Result / Action to Take
B1 CHECK PARKING BRAKE CONTROL	
● Raise and support the vehicle. Refer to Section 100-02 . ● Release parking brake by pulling upward on hand lever and pushing release button. ● **Did parking brake release?**	**Yes** GO to B2 . **No** INSTALL a new parking brake control. RESTORE the vehicle and TEST the system for normal operation.
B2 CHECK PARKING BRAKE CABLES	
● Loosen tensioner. Refer to Parking Brake Cable Tension Release in this section. ● Move the gearshift lever to NEUTRAL position. ● Rotate rear wheels by hand. ● **Did rear wheels turn freely?**	**Yes** GO to B3 . **No** INSTALL new parking brake cables. RESTORE the vehicle and TEST the system for normal operation.
B3 CHECK REAR PARKING BRAKE LEVERS	
● Disconnect parking brake levers one at a time. ● Rotate wheel affected by disconnected parking brake lever. ● **Did wheel turn freely?**	**Yes** INSTALL a new parking brake lever. RESTORE vehicle and TEST the system for normal operation. **No** REPAIR or INSTALL a new rear brake component if worn or damaged. TEST the system for normal operation.

Parking Brake Cable Tension Release

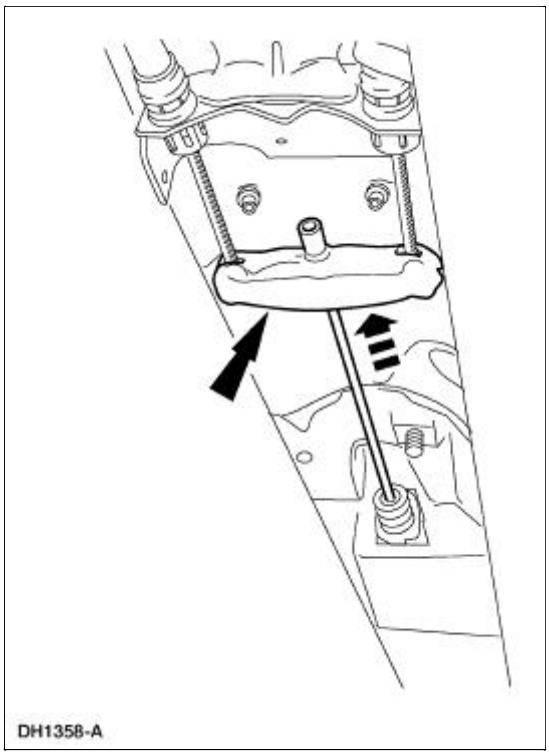
1. **CAUTION: If any component in the parking brake system requires repair or if the rear axle housing (4010) is removed, the cable tension must be released.**

   Place the parking brake control (2780) in the released position.

2. Remove the console. For additional information, refer to Section 501-12 .

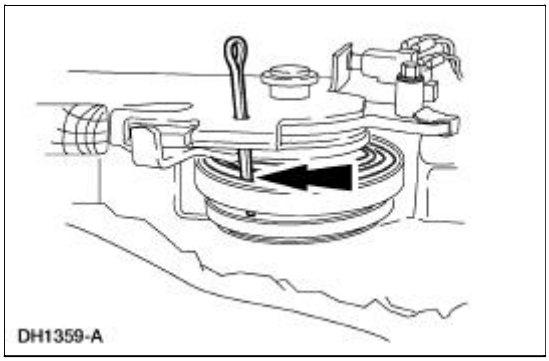
3. With an assistant inside the vehicle, raise and support the vehicle. For additional information, refer to Section 100-02 .

4. Pull the parking brake cable and equalizer rearward.



5. **CAUTION: Do not remove the steel pin until the parking brake cable and equalizer/rear cable and conduits are connected to the parking brake control. Pin removal releases the tension in the ratchet wheel causing the spring to unwind and release tension.**

   Insert a steel pin through holes in the lever to the ratchet wheel.


DH1359-A

Parking Brake Control

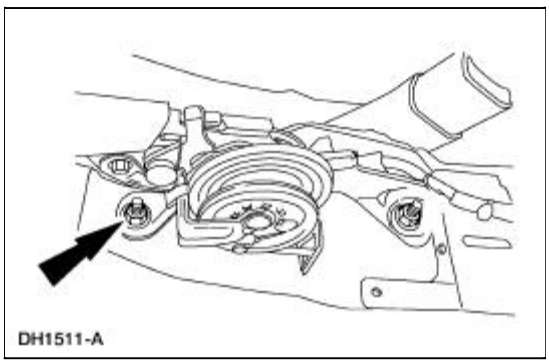
Removal

1. **CAUTION: If any component in the parking brake system requires repair or if the rear axle housing (4010) is removed, the cable tension must be released.**

   Place the parking brake control (2780) in the released position.

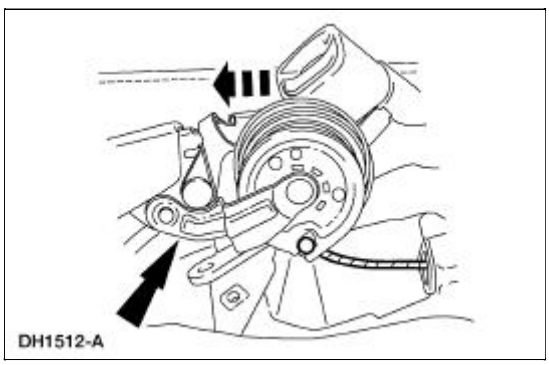
2. Remove the console. For additional information, refer to Section 501-12 .

3. Remove the parking brake control studs.

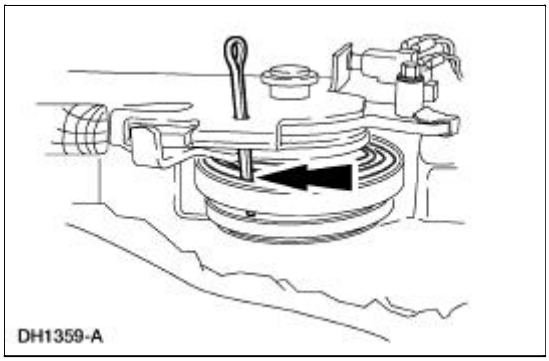


4. **NOTE:** Self adjust pawl must be off to allow wind up.

   Place the control handle in the fully downward position, then pull the control handle forward to wind-up the self-adjusting mechanism.

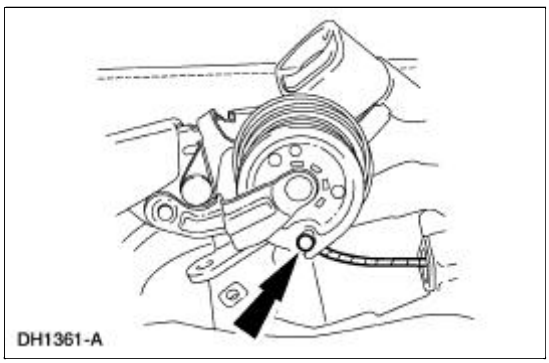


5. Insert a steel pin through hole in the lever to the ratchet wheel, then carefully release the spring tension onto the pin.



6. **NOTE:** Keep tension on the cable so cable end does not fall out of equalizer.

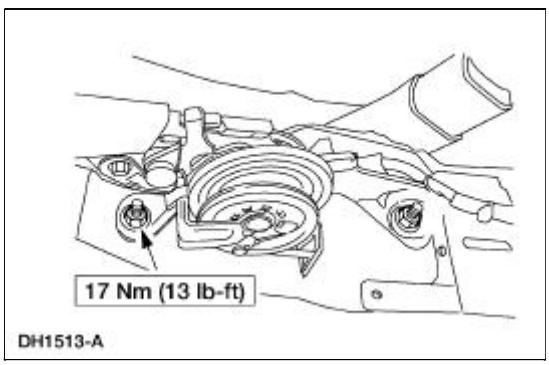
   Disconnect the parking brake cable.



Installation

1. **NOTE:** Make sure cable ends are attached to the equalizer.

   Follow the removal procedure in reverse order.



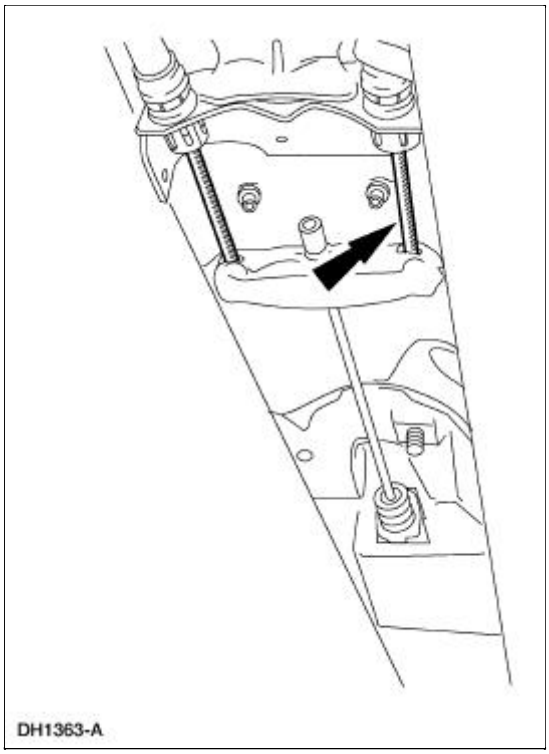
Cable and Conduit —Front

Removal

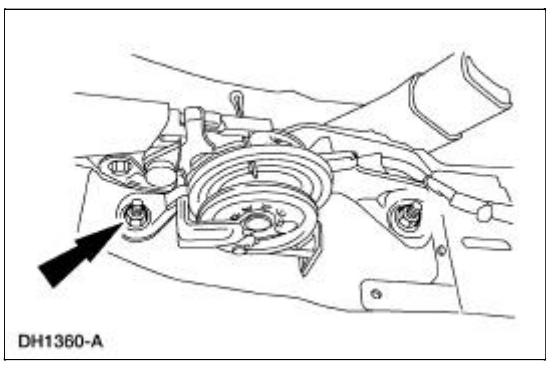
1. **CAUTION: If any component in the parking brake system requires repair or if the rear axle housing (4010) is removed, the cable tension must be released.**

   Release the cable tension. For additional information, refer to Parking Brake Cable Tension Release in this section.

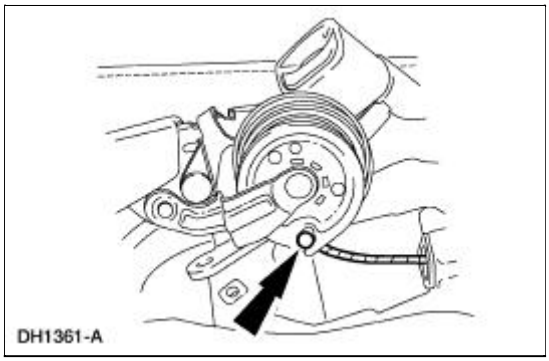
2. Disconnect the parking brake rear cables and conduits.



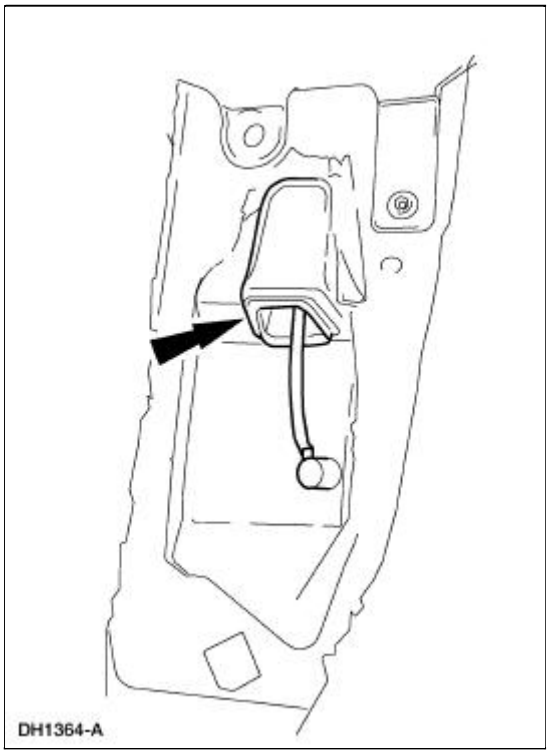
3. Remove the parking brake control nuts.



4. Disconnect the parking brake cable.

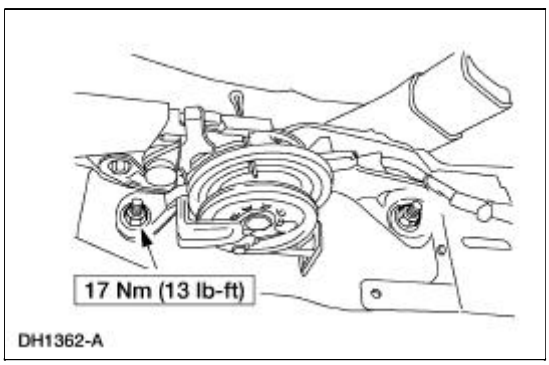


5. Pull the front cable and equalizer through the floorpan from inside the vehicle.



Installation

1. Follow the removal procedure in reverse order.



Cable and Conduit

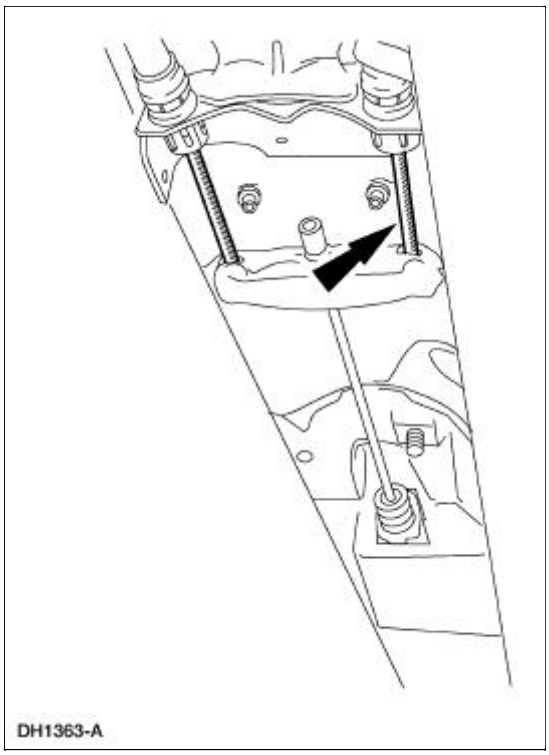
Removal

NOTE: The RH rear is shown, the LH is similar.

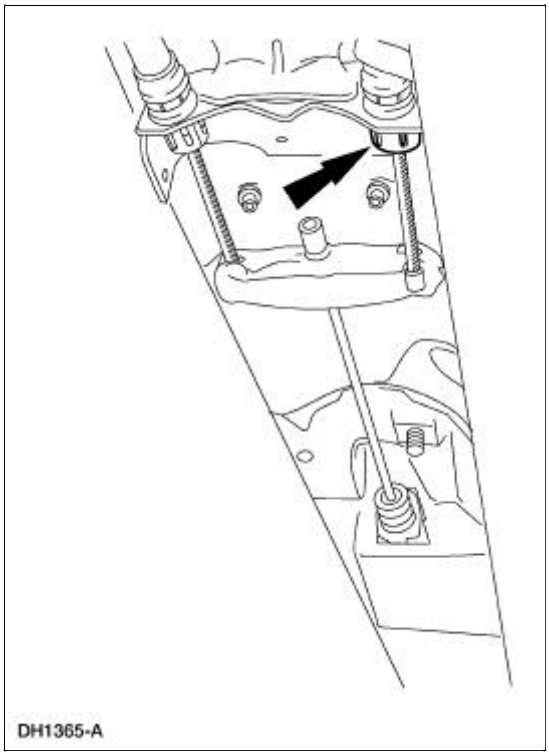
1. **CAUTION: If any component in the parking brake system requires repair or if the rear axle housing (4010) is removed, the cable tension must be released.**

   Release the cable tension. For additional information, refer to Parking Brake Cable Tension Release in this section.

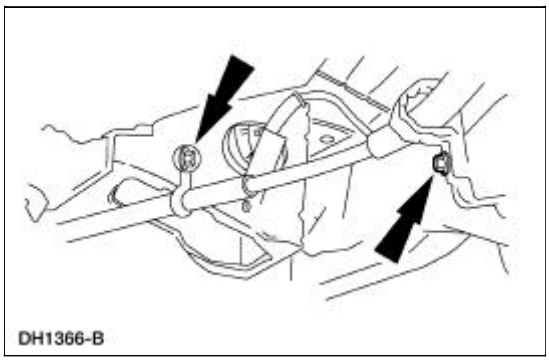
2. Disconnect the parking brake rear cable and conduit.



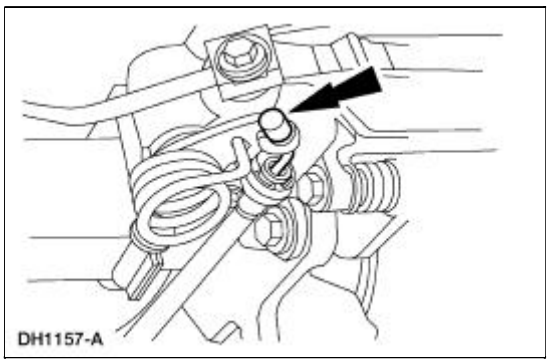
3. Using a 13 mm (0.52 in) box-end wrench, depress the conduit retaining prongs and remove the parking brake rear cable and conduit.



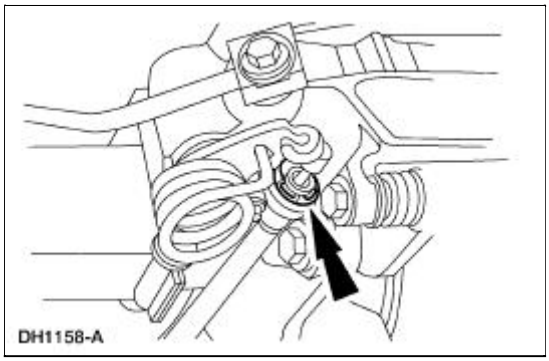
4. Remove the parking brake rear cable and conduit from the routing clip bolts.



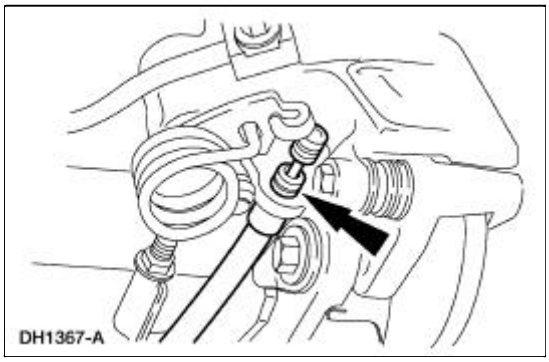
5. Disconnect the parking brake rear cable and conduit from the parking brake lever (2A637).



6. Remove the clip from the rear disc brake caliper (2552).

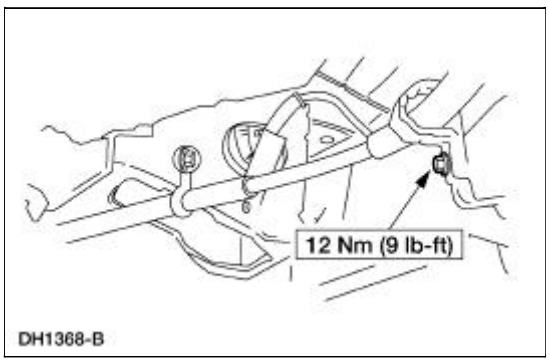


7. Remove the parking brake rear cable and conduit from the rear disc brake caliper.



Installation

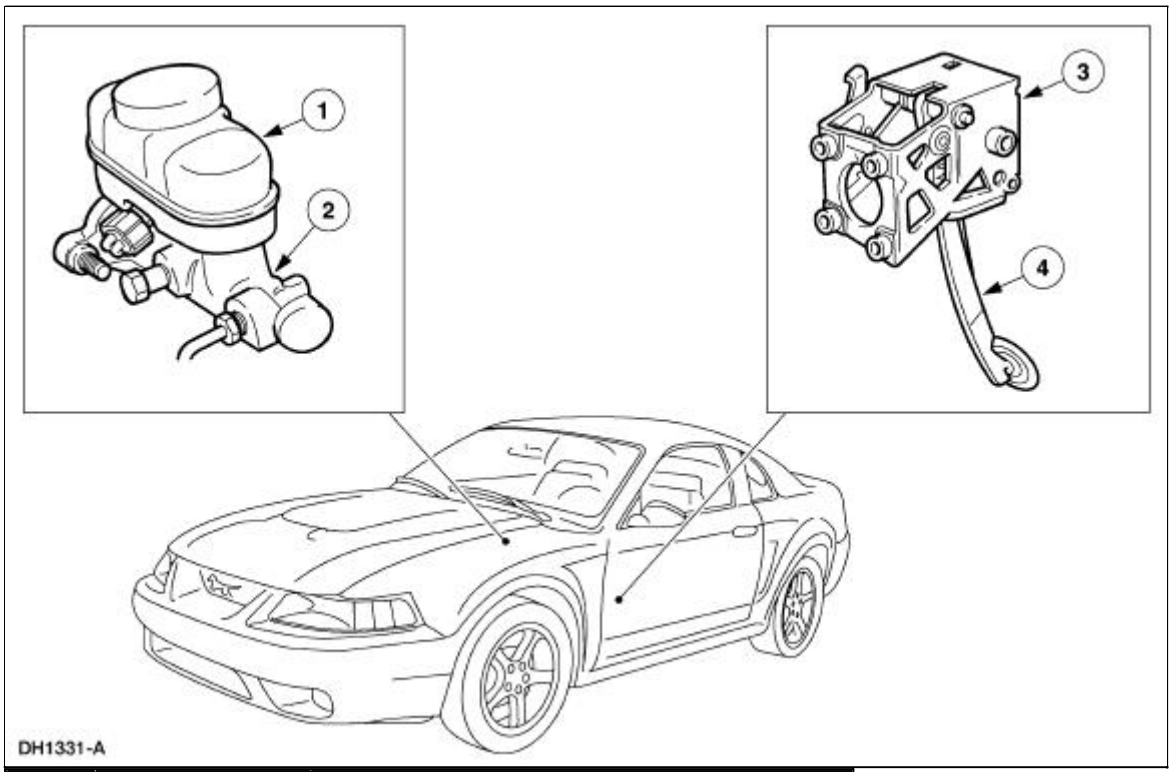
1. Follow the removal procedure in reverse order.



Torque Specifications

Description	Nm	lb-ft
Brake master cylinder nuts	25	19
Brake pedal bracket nuts	25	19
Brake pedal bracket bolt	23	17
Brake fluid control valve	19	15
Hydraulic tube connections	17	13
Brake fluid control valve bracket nut	14	11

Hydraulic Brake Actuation



Item	Part Number	Description
1	2K478	Master cylinder reservoir
2	2140	Master cylinder
3	—	Pedal support bracket (part of 2455)
4	2455	Brake pedal

CAUTION: Blistering or swelling of rubber brake components may indicate contamination of the brake fluid by a petroleum based substance. New rubber components must be installed in the hydraulic brake system if contaminated and the entire hydraulic brake system must be flushed with clean brake fluid to prevent recontamination.

This vehicle is equipped with a brake pedal actuated dual brake system. The system consists of the following:

- power brake booster (2005)
- brake master cylinder (2140)
- brake pressure control valve (2B091)
- disc brake calipers (2B120)
- rear disc brake calipers (2553)
- brake tubes and hoses
- anti-lock brake system (ABS) components

The dual brake system is split front and rear with the front wheel brakes comprising of one circuit and the rear wheel brakes, the other circuit.

Brake Fluid

WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

Clean, fresh Ford High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent DOT 3 fluid meeting Ford specification ESA-M6C25-A is the only brake fluid that should be used in Ford vehicles.

- Do not reuse brake fluid drained or bled from the system.
- Do not use brake fluid that has been stored in an open container.
- Do not mix different types of brake fluid.

Brake Master Cylinder

The brake master cylinder is a dual piston type. The brake master cylinder operates as follows:

- When the brake pedal (2455) is depressed, pressure is applied by mechanical linkage to the primary and secondary piston.
- Brake master cylinder pistons apply hydraulic pressure to the two hydraulic circuits.
- Brake master cylinder will not be overhauled, a new master cylinder is installed only.

The brake master cylinder consists of:

- brake master cylinder reservoir (2K478)
- brake master cylinder body

Brake Master Cylinder Reservoir

NOTE: Whenever the brake master cylinder reservoir is removed from the brake master cylinder, new grommets must be installed.

The brake master cylinder reservoir :

- is mounted to the brake master cylinder.
- holds fluid supply for each brake master cylinder hydraulic piston.
- provides visual fluid level markings.
- contains the brake master cylinder fluid level sensor.

Brake Pressure Control Valve

The brake pressure control valve proportions the pressure to the rear brakes.

- When the brake pedal is applied, brake fluid pressure passes through the proportioning valves to the rear brake system until the valve split point is reached.
- Above its split point, the proportioning valve begins to reduce the hydraulic pressure to the rear brakes, creating a balanced braking condition between the front and rear brakes.

Brake Tubes and Hoses

CAUTION: Never use copper tubing. It is subject to fatigue, cracking and corrosion which could result in brake tube failure.

Steel tubing is used throughout the brake hydraulic system. All brake tube fittings must be correctly double flared to provide strong leakproof connections. When bending the tubing to fit the underbody or rear axle contours, be careful not to kink or crack the tube.

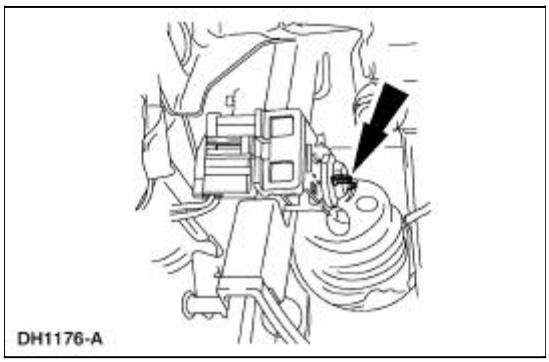
If a section of brake tube is damaged, the entire section must be removed and a new tube of the same type, size, shape and length installed.

When replacing hydraulic brake tubing, hoses, or connectors, tighten all connections securely. After installation, bleed the brake system. For additional information, refer to Section 206-00 .

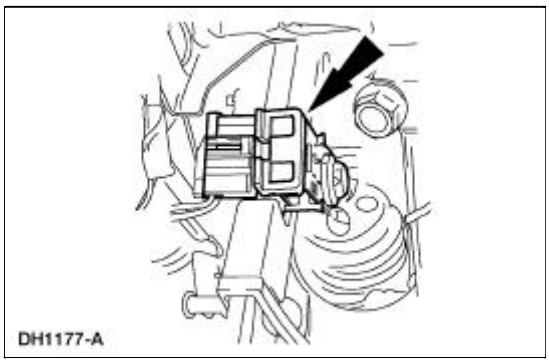
Pedal and Bracket

Removal

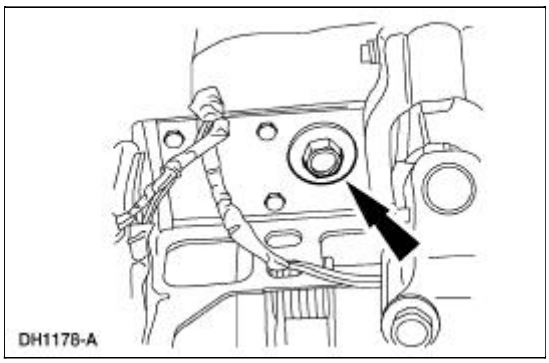
1. Disconnect the battery ground cable (14301). For additional information, refer to Section 414-01 .
2. Remove the stoplight switch retaining pin.



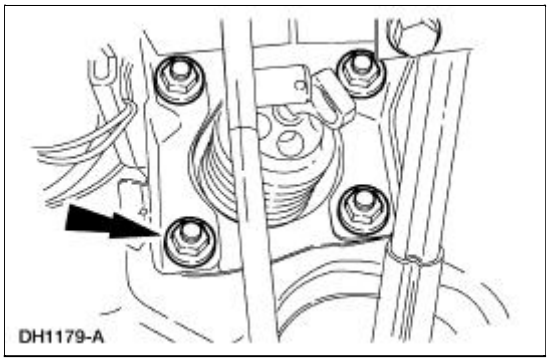
3. Slide the stoplight switch (13480) and booster push rod from the brake pedal pin.



4. Remove the brake pedal bracket retaining bolt.



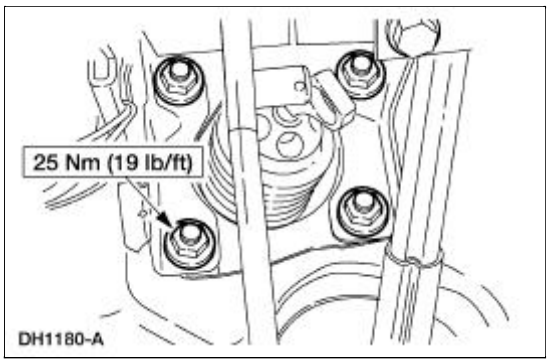
5. Remove the brake pedal bracket retaining nuts.

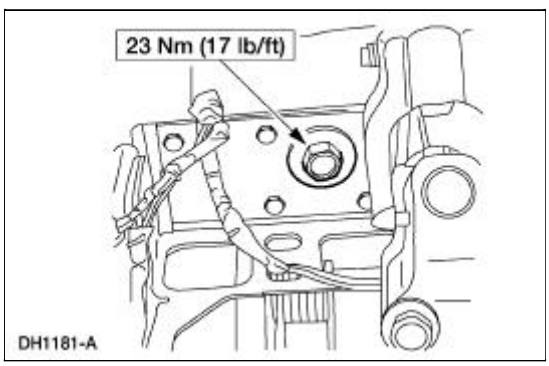


6. Remove the brake pedal and bracket.

Installation

1. To install, reverse the removal procedure.

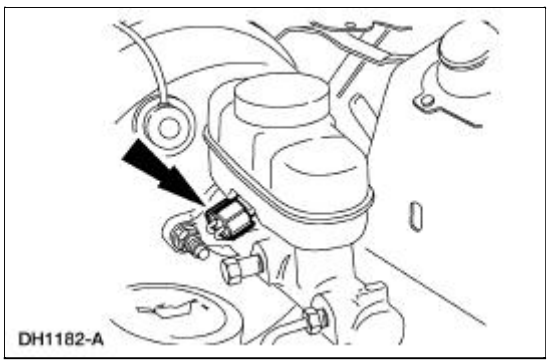




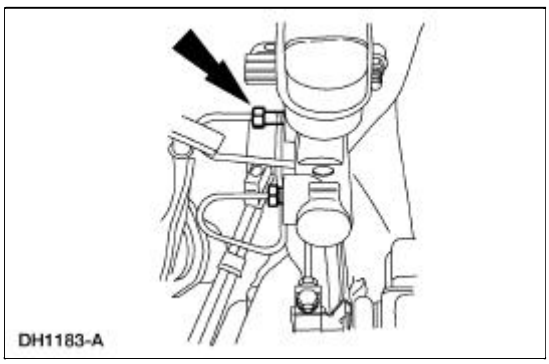
Master Cylinder

Removal

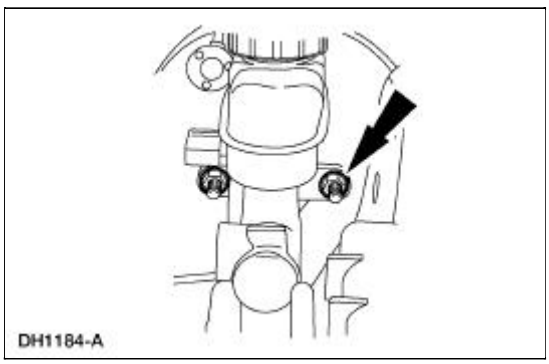
1. Disconnect the fluid level sensor connector.



2. Disconnect the brake tubes.



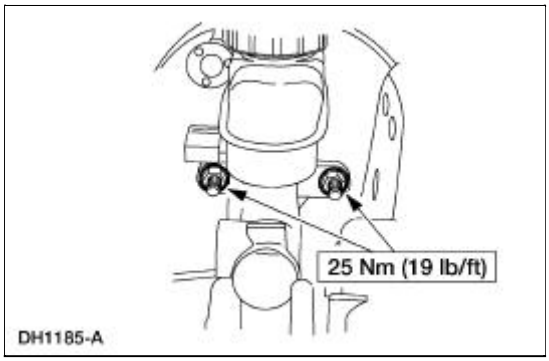
3. Remove the brake master cylinder nuts.

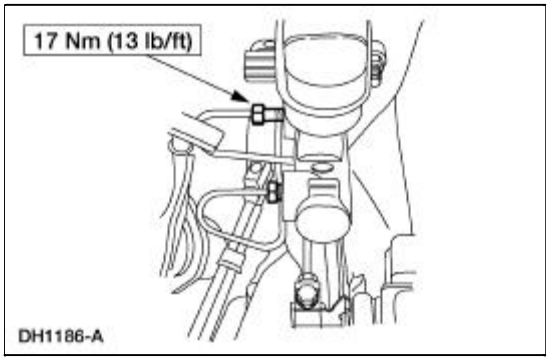


4. Remove the brake master cylinder (2140).

Installation

1. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to Section 206-00 .

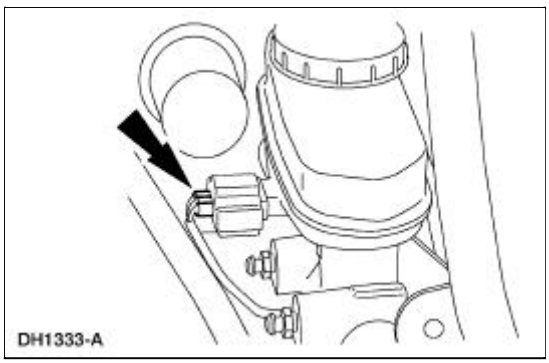

25 Nm (19 lb/ft)
DH1185-A


17 Nm (13 lb/ft)
DH1186-A

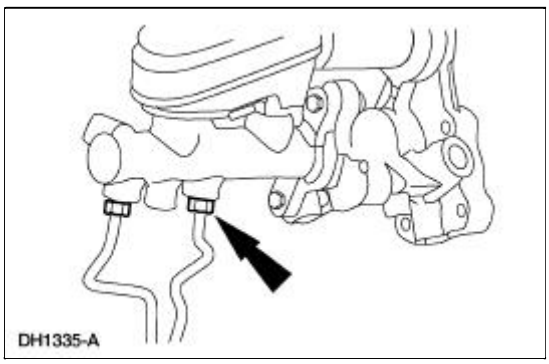
Master Cylinder —Hydro-Boost

Removal

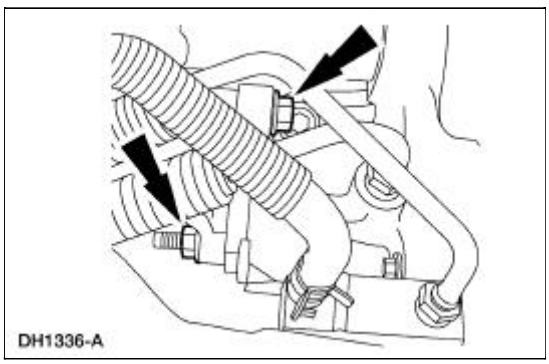
1. Disconnect the fluid level sensor connector.



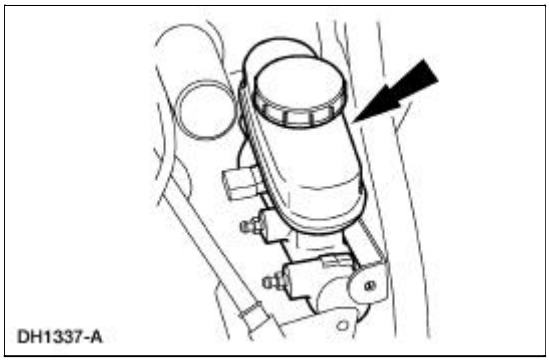
2. Disconnect the brake tubes.



3. Remove the brake master cylinder nuts.

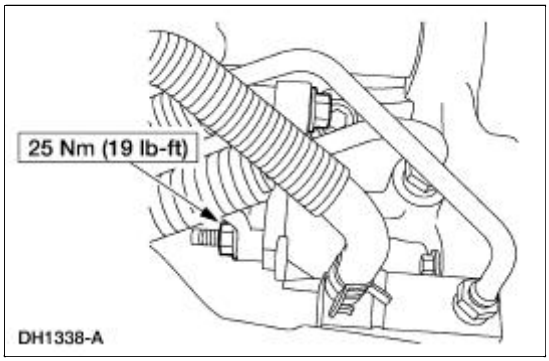


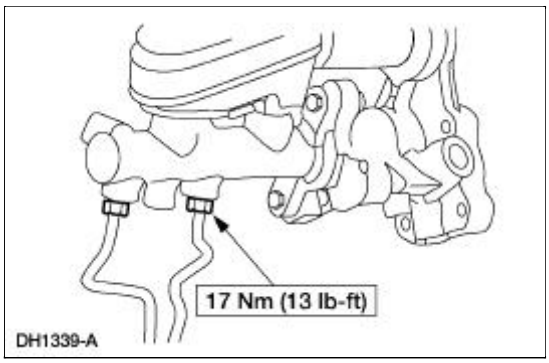
4. Remove the brake master cylinder (2140).



Installation

1. To install, reverse the removal procedure.
    - Bleed the brake system. For additional information, refer to Section 206-00 .



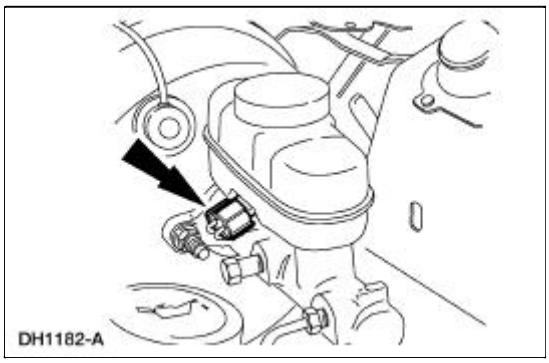


Reservoir

Removal

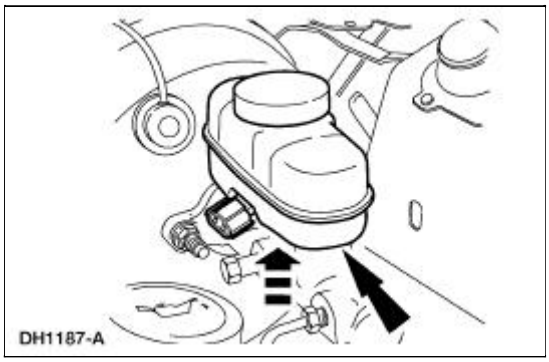
WARNING: Brake fluid contains polyglycol ethers and polyglycols. Avoid contact with eyes. Wash hands thoroughly after handling. If brake fluid contacts eyes, flush eyes with running water for 15 minutes. Get medical attention if irritation persists. If taken internally, drink water and induce vomiting. Get medical attention immediately.

1. Disconnect the brake master cylinder fluid level switch.



2. Use a suitable suction device to drain the brake master cylinder reservoir (2K478).

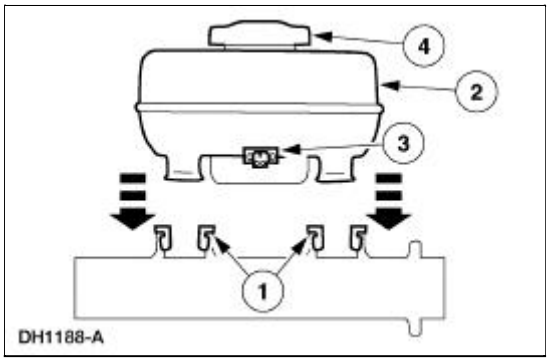
3. Carefully pry up on the brake master cylinder reservoir and remove.



Installation

1. **NOTE:** Whenever installing a new brake master cylinder reservoir, install new grommets.

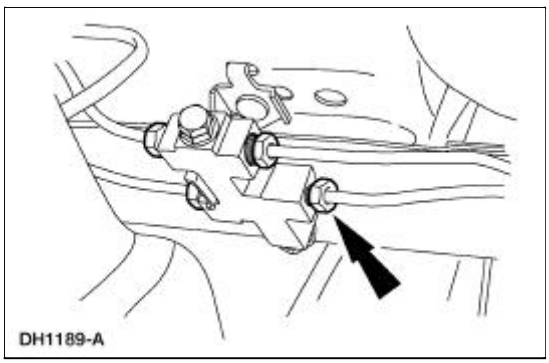
   Install the brake master cylinder reservoir.
   1. Lubricate the two grommets with High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent fluid meeting Ford specification ESA-M6C25-A and insert the grommets into the brake master cylinder (2140).
   2. Press the brake master cylinder reservoir into the grommets until it is fully seated.
   3. Connect the brake master cylinder fluid level switch.
   4. Fill the brake master cylinder reservoir with clean High Performance DOT 3 Brake Fluid C6AZ-19542-AB or equivalent fluid meeting Ford specification ESA-M6C25-A.
   5. Bleed the brake master cylinder. For additional information, refer to Section 206-00.


4
2
3
1
DH1188-A

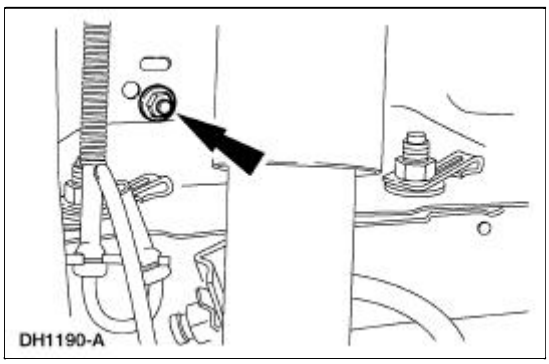
Control Valve

Removal

1. Disconnect the brake tubes.

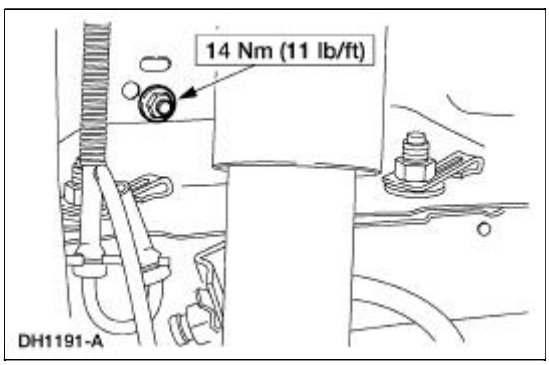


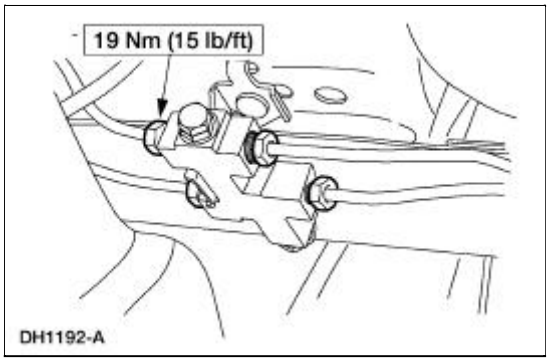
2. Remove the brake fluid control valve bracket nut.



Installation

1. To install, reverse the removal procedure.



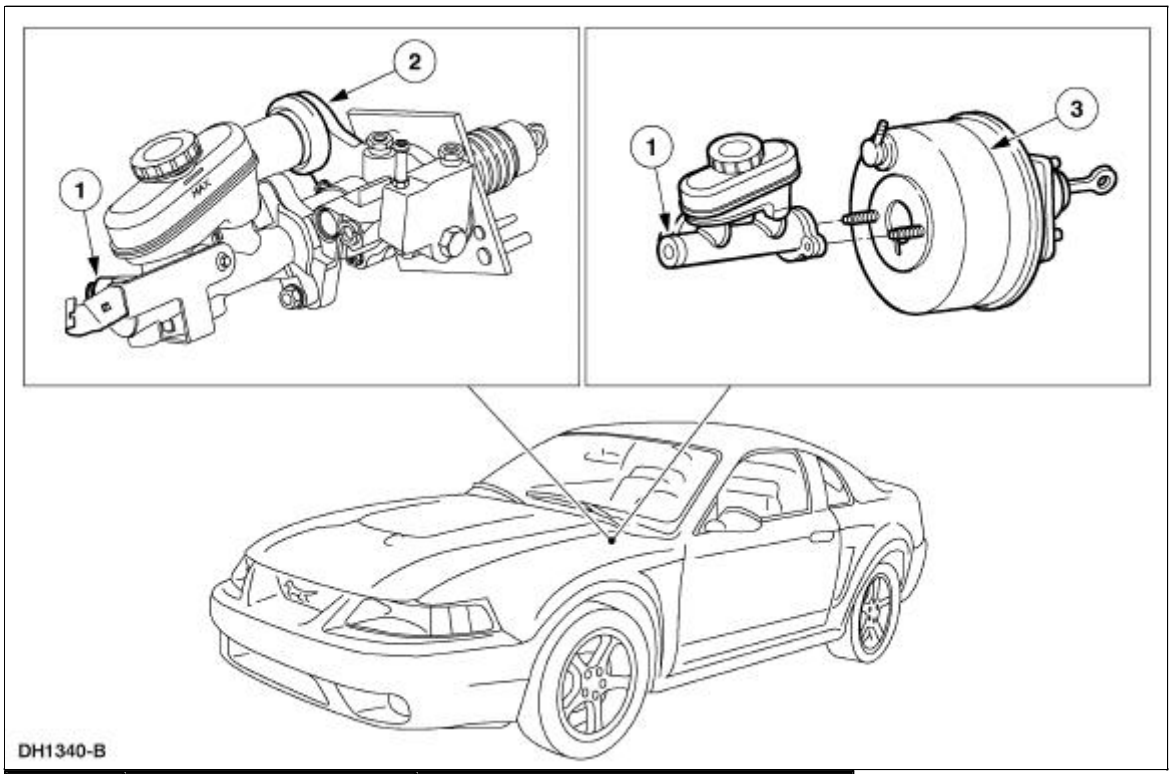

19 Nm (15 lb/ft)
DH1192-A

Torque Specifications

Description	Nm	lb-ft
Power brake booster nuts	25	19
Brake master cylinder nuts	25	19
Hydraulic tube connections	17	13
Power steering pressure lines	19	14

Brake Booster —Vacuum

Power Brake Booster



Item	Part Number	Description
1	2140	Master cylinder
2	2B560	Hydro-Boost
3	2005	Power brake booster

The vacuum type power brake booster (2005):

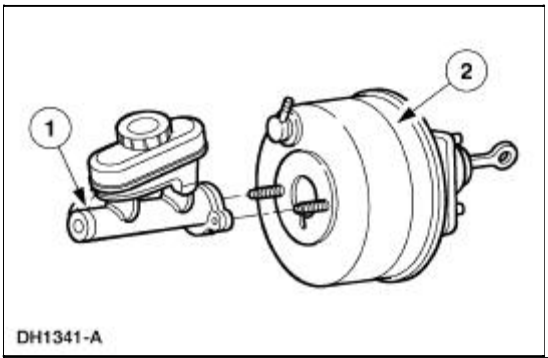
- is a dual diaphragm, vacuum assisted power brake booster
- reduces brake pedal force and travel distance.
- is located on the LH side of the bulkhead in the engine compartment, between the brake pedal (2455) and the brake master cylinder (2140).
- is divided into separate chambers by the diaphragms.
- will not operate if vacuum is restricted or if any of the vacuum related power brake components fail.
- is installed as an assembly.

If the power assist fails, the brake system will continue to operate with increased brake pedal effort.

Hose and Check Valve

The power brake booster check valve (2365):

- is located on the front of the power brake booster.
- is installed separately; (install a new grommet when installing a new check valve).
- is positioned between the power brake booster and the power brake booster hose.
- closes when the engine is turned off.
- in the closed position, traps engine vacuum in the power brake booster
- retains vacuum to provide several power assisted brake applications with the engine off.



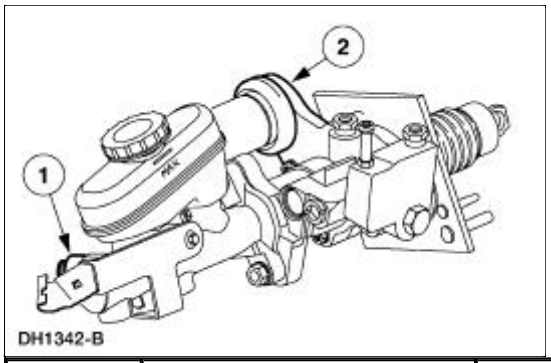
Item	Part Number	Description
1	2140	Master cylinder
2	2005	Power brake booster

Brake Booster —Hydro-Boost

The Hydro-Boost brake booster is a hydraulically operated brake booster powered by the power steering pump (3A674). The power steering pump provides the fluid pressure to operate both the power brake booster and the power steering gear (3504).

A Hydro-Boost reserve system (accumulator) stores sufficient fluid under pressure to provide at least two power-assisted brake applications in the event the power steering pump fluid flow is interrupted.

For low assist concerns on vehicles equipped with the Hydro-Boost system, refer to Section 211-00 to check the power steering pump pressure and flow.



Item	Part Number	Description
1	2140	Master cylinder
2	2B559	Hydro-Boost

The brakes can also be applied manually if the reserve system is depleted.

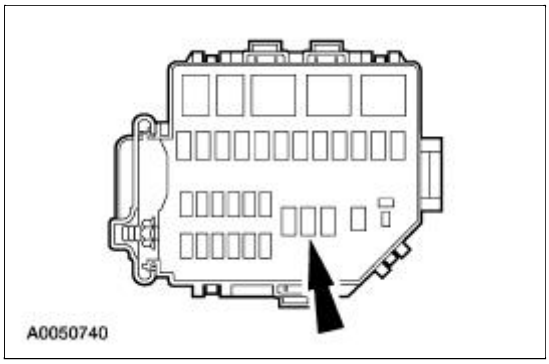
Any leakage goes directly back to the power steering pump reservoir (3E764).

Hydro-Boost Bleeding

1. **NOTE:** The Hydro-Boost power brake booster (2B560) is generally self-bleeding, and the following procedure will normally bleed the air from the power brake booster. Normal operation of the vehicle will further remove any additional trapped air.

   Fill the power steering oil reservoir (3A697) with MERCON® Multi-Purpose ATF XT-2-QDX or MERCON® equivalent.

2. Remove the powertrain control module (PCM) fuse to prevent the engine from starting.



3. Crank the engine for several seconds.

4. Check the fluid level in the power steering oil reservoir and add if necessary. Install the powertrain control module (PCM) fuse.

5. Start the engine.

6. With the engine running, turn the steering wheel (3600) from stop-to-stop twice. Turn the engine off.

7. Depress the brake pedal (2455) several times to discharge the accumulator.

8. Repeat Steps 5 and 6.

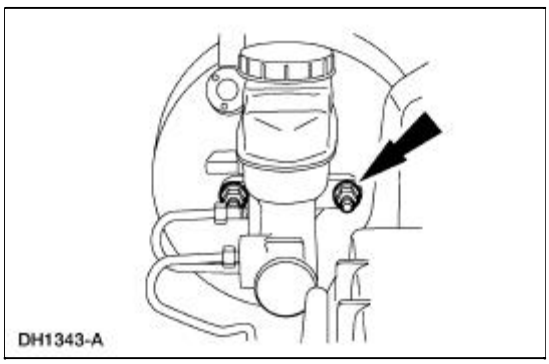
9. If foaming occurs, stop the engine and allow the foam to dissipate.

10. Repeat Steps 5 and 6 as required, until all the air is removed from the system (when the foaming stops).

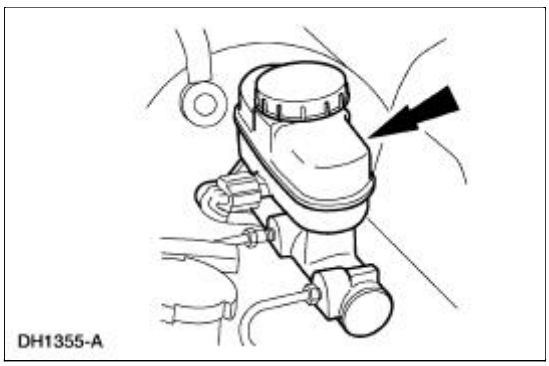
Brake Booster —Vacuum

Removal

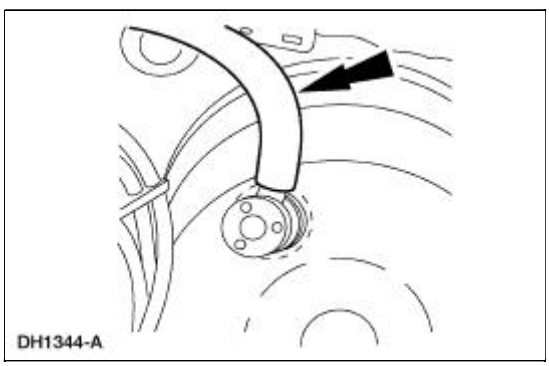
1. Disconnect the battery ground cable (14301). For additional information, refer to Section 414-01 .
2. Remove the air cleaner housing. For additional information, refer to Section 303-12 .
3. Remove the brake master cylinder nuts.



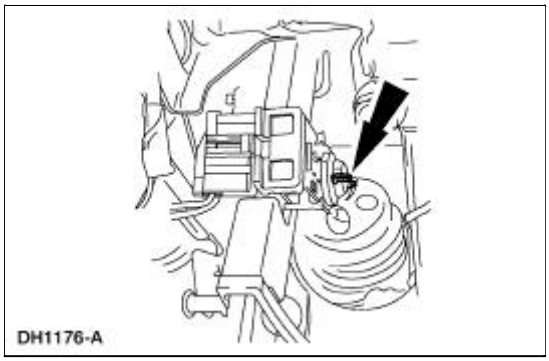
4. Position the brake master cylinder (2140) aside.



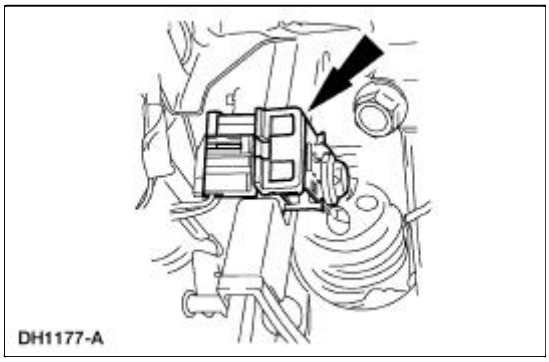
5. With the engine off, depress the brake pedal (2455) several times to discharge the accumulator. Disconnect the booster vacuum hose.



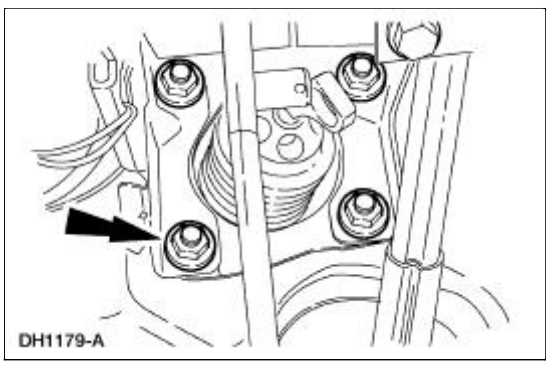
6. Remove the stoplight switch self-locking pin.



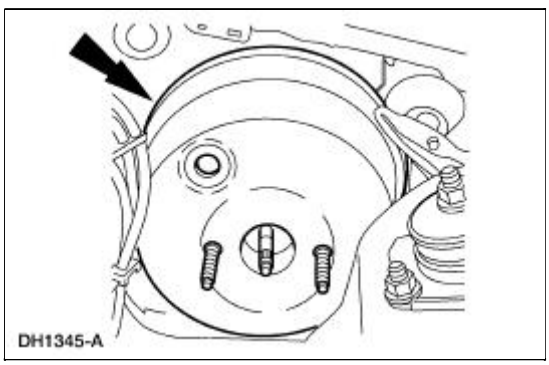
7. Remove the stoplight switch (13480) and the brake booster push rod from the brake pedal pin.



8. Remove the power brake booster nuts.

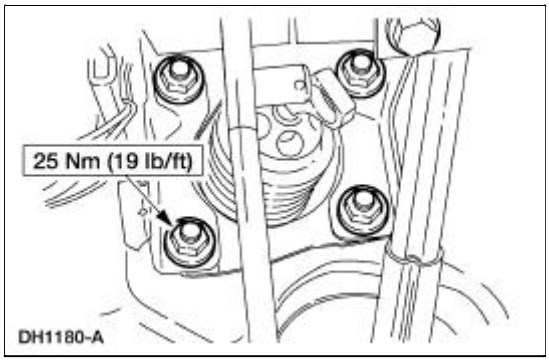


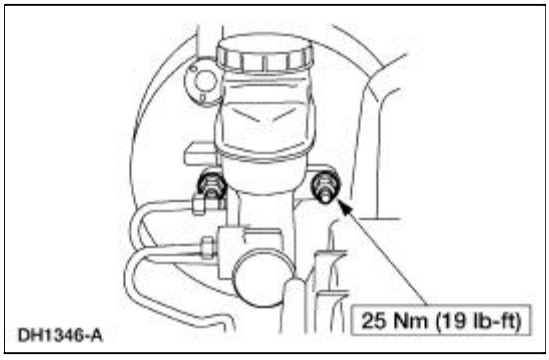
9. Remove the power brake booster (2005).



Installation

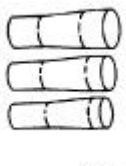
1. Follow the removal procedure in reverse order.


25 Nm (19 lb/ft)
DH1180-A


25 Nm (19 lb-ft)
DH1346-A

Brake Booster —Hydro-Boost

Special Tool(s)

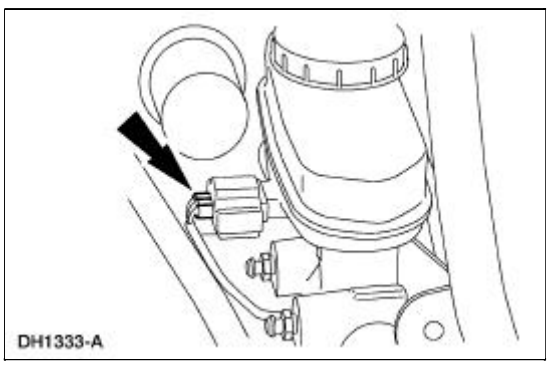
 ST1444-A	Installer Set, Teflon Seal 211-D027 (D90P-3517-A) or equivalent

Removal

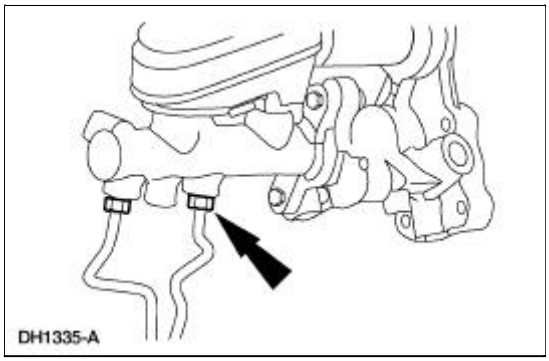
WARNING: The power brake booster should not be carried by the accumulator, nor should it ever be dropped on the accumulator. Check the snap ring on the accumulator for correct seating before the power brake booster is used. The accumulator contains high-pressure nitrogen gas and can be dangerous if mishandled.

WARNING: If the accumulator is to be disposed of, it must not be exposed to excessive heat. Before discarding the accumulator, drill a 1.6-mm (1/16-inch) diameter hole in the end of the accumulator can to relieve the gas pressure. Always wear safety glasses when performing this operation.

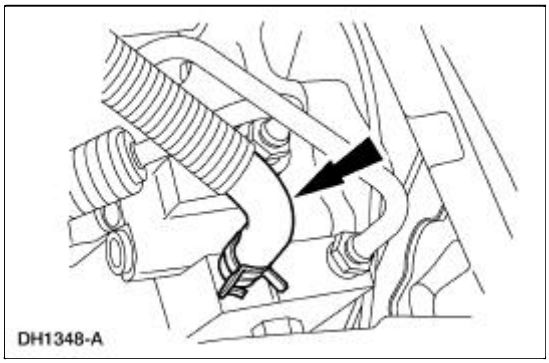
1. With the engine off, depress the brake pedal (2455) several times to discharge the accumulator.
2. Disconnect the battery ground cable (14301). For additional information, refer to Section 414-01 .
3. Disconnect the fluid level sensor connector.



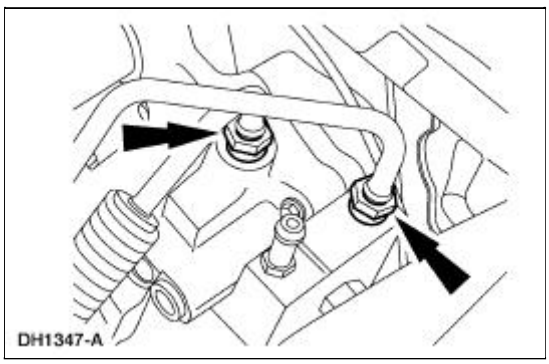
4. Disconnect the brake tubes.



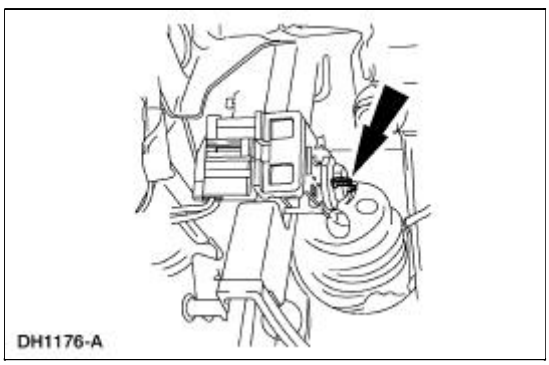
5. Disconnect the power steering return line hose (3A005).



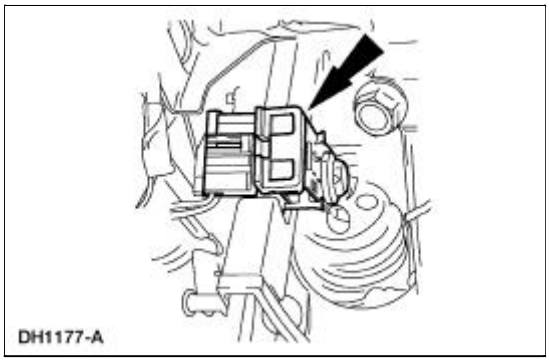
6. Disconnect the power steering pressure lines.



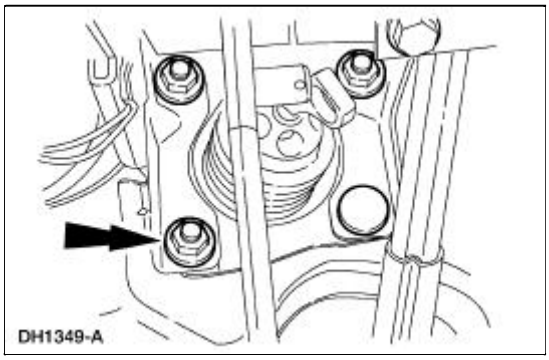
7. Remove the self-locking pin.



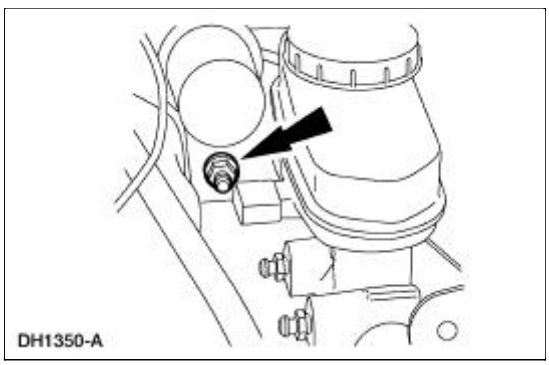
8. Remove the stoplight switch (13480) and the brake booster push rod from the brake pedal pin.



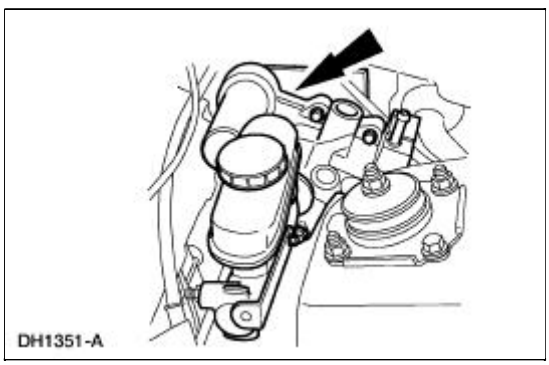
9. Remove the power brake booster nuts.



10. Remove the power brake booster nut.



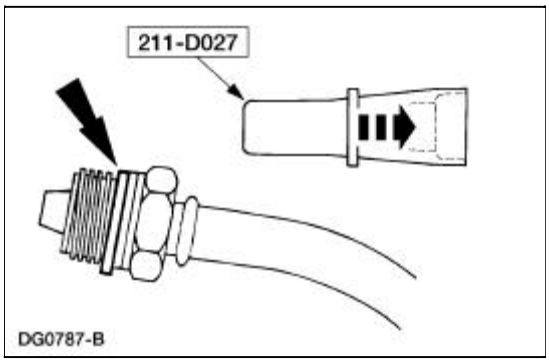
11. Remove the booster.

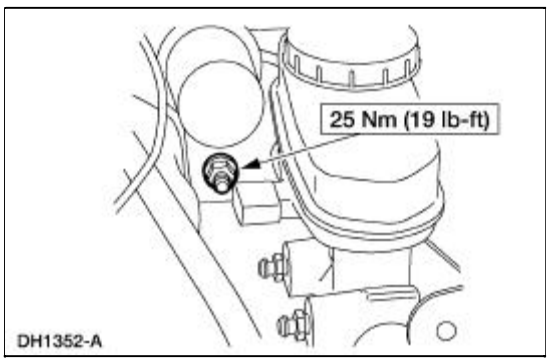


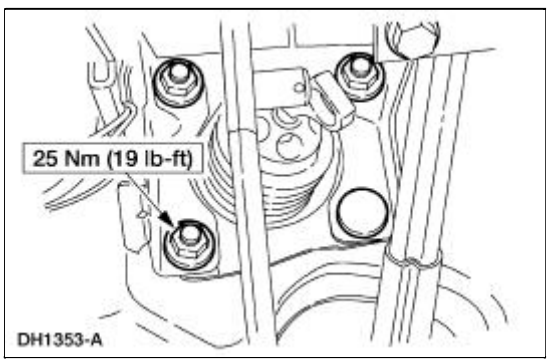
Installation

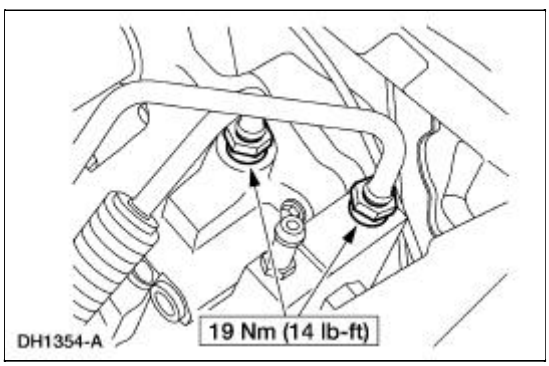
1. Follow the removal procedure in reverse order.
    - Install new Teflon® seals on the power steering pressure fittings.

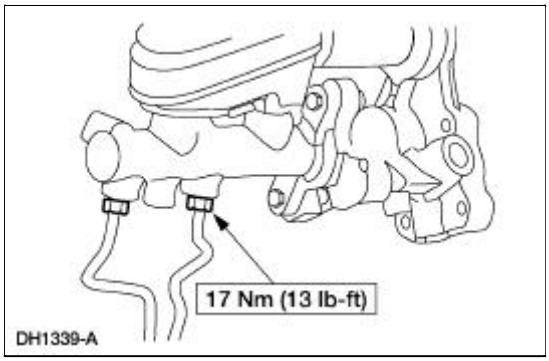
- Bleed Hydro-Boost. For additional information, refer to Hydro-Boost Bleeding in this section.
- Bleed the brake system. For additional information, refer to Section 206-00 .










17 Nm (13 lb-ft)
DH1339-A

Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake control module screws	3	—	26
Brake line fittings to hydraulic control unit	19	14	—
Front anti-lock brake sensor bolt	7	—	62
Hydraulic control unit to mounting bracket nuts	18	13	—
Rear anti-lock brake sensor bolt	7	—	62

Anti-Lock Control

The four wheel anti-lock brake system (4WABS) consists of the following components:

- anti-lock brake control module (2C346)
- front anti-lock brake sensor (2C205)
- front anti-lock brake sensor indicator (2C182)
- hydraulic control unit (2C286)
- rear anti-lock brake sensor (2C216)
- rear anti-lock brake sensor indicator (2C189)
- yellow anti-lock brake system (ABS) warning indicator

Anti-Lock Control

Refer to Wiring Diagrams Cell 42 , Anti-Lock Brake for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
ST1137-A	73 Digital Multimeter or equivalent 105-R0051

Principles of Operation

The anti-lock brake control module receives wheel speed readings from each anti-lock brake sensor and processes this information to determine if an ABS event is necessary. The anti-lock brake sensor electrically senses each tooth of the anti-lock brake sensor indicators as it passes through the anti-lock brake sensor's magnetic field.

The anti-lock brake control module continuously monitors and compares the rotational speed of each wheel, and when it detects an impending wheel lock, modulates hydraulic brake pressure to the appropriate brake caliper. This is accomplished by the anti-lock brake control module triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the anti-lock brake control module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The anti-lock brake control module is self-monitoring. When the ignition switch is turned to the RUN position, the anti-lock brake control module will do a preliminary electrical check, and at approximately 12 km/h (8 mph) the pump motor is turned on for approximately one half-second. Any malfunction of the ABS will cause the ABS to shut off and the yellow ABS warning indicator to illuminate, however, normal power assisted braking remains.

The ABS control module has the ability to store multiple DTCs in memory.

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
● Low brake fluid ● Anti-lock brake sensor ● Anti-lock brake sensor indicator ● Base brake system	● Central junction box (CJB)Fuse: ■ 15 (10A) ■ 29 (15A) ■ 33 (15A) ■ 35 (15A) ● Battery junction box (BJB) Fuse: ■ ABS 1 (50A) ■ ABS 2 (20A) ● Circuitry ● Damaged or corroded connectors ● Yellow ABS warning indicator ● Loose grounds

3. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
    1. Check that the program card is correctly installed.
    2. Check the connections to the vehicle.
    3. Check the ignition switch position.

4. If the scan tool still does not communicate with the vehicle, refer to the scan tool Manual.

5. Carry out the DATA LINK DIAGNOSTIC TEST. If the scan tool responds with:
    1. CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to Section 418-00.
    2. NO RESP/NOT EQUIP for the anti-lock brake control module, Go To Pinpoint Test A .
    3. SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the anti-lock brake control module.

6. If the DTCs retrieved are related to the concern, go to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Reference Chart to continue diagnostics.

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

NOTE: If a wheel speed signal fault or a pump motor fault is detected, the yellow ABS warning indicator cannot be reset with the key OFF and key ON method. The vehicle must be driven over 12 km/h (8 mph) for the anti-lock brake control module to carry out a re-check of the system before the yellow ABS warning indicator is turned OFF.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1318	Battery Voltage Low	ABS	Go To Pinpoint Test C .
B1342	ECU Is Defective	ABS	INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test.
B1484	Brake Pedal Input Open Circuit	ABS	Go To Pinpoint Test D .

B1596	Repair Continuous Codes	ABS	REPAIR the DTCs retrieved.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS	Go To Pinpoint Test E .
C1145	RF Anti-Lock Brake Sensor Input Circuit Failure	ABS	Go To Pinpoint Test F .
C1155	LF Anti-Lock Brake Sensor Input Circuit Failure	ABS	Go To Pinpoint Test F .
C1165	RR Anti-Lock Brake Sensor Input Circuit Failure	ABS	Go To Pinpoint Test F .
C1175	LR Anti-Lock Brake Sensor Input Circuit Failure	ABS	Go To Pinpoint Test F .
C1222	Anti-Lock Brake Sensor Mismatch	ABS	Go To Pinpoint Test G .
C1233	LF Anti-Lock Brake Sensor Input Signal Missing	ABS	Go To Pinpoint Test H .
C1234	RF Anti-Lock Brake Sensor Input Signal Missing	ABS	Go To Pinpoint Test H .
C1235	RR Anti-Lock Brake Sensor Input Signal Missing	ABS	Go To Pinpoint Test H .
C1236	LR Anti-Lock Brake Sensor Input Signal Missing	ABS	Go To Pinpoint Test H .
C1266	ABS Valve Power Relay Circuit Failure	ABS	Go To Pinpoint Test I .

Anti-Lock Brake Control Module Parameter Identification (PID) Index

Anti-Lock Brake Control Module Parameter Identification (PID) Index

PID	Description	Expected Value
CCNTABS	Number of Continuous DTCS in the Anti-Lock Brake Control Module	one count per bit
BOO_ABS	Brake Switch Input	OFF, ON
PMP_MTR	ABS Pump Motor	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
VLV_CTR	ABS Valve Control Relay	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
LF_WSPD	LF Wheel Speed	0-255 MPH
RF_WSPD	RF Wheel Speed	0-255 MPH
LR_WSPD	LR Wheel Speed	0-255 MPH
RR_WSPD	RR Wheel Speed	0-255 MPH
ABSLF_I	LF ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSLF_O	LF ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG

ABSRF_I	RF ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSRF_O	RF ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSR_I	Rear ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSR_O	Rear ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG

Anti-Lock Brake Control Module Active Command Index

Anti-Lock Brake Control Module Active Command Index

Active Command	Display	Action
ABS OUTPUT CONTROL	ABS POWER	OFF, ON
	DSBL TOG	OFF, ON
	LF INLET	OFF, ON
	LF OUTLET	OFF, ON
	RF INLET	OFF, ON
	RF OUTLET	OFF, ON
	R INLET	OFF, ON
	R OUTLET	OFF, ON

Symptom Chart

Symptom Chart

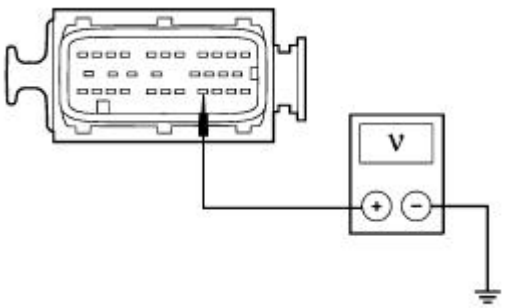
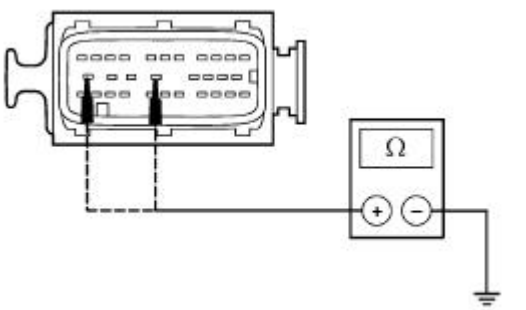
NOTE: Refer to the Wiring Diagrams for connector numbers stated in the Pinpoint tests.

Condition	Possible Sources	Action
• No communication with the anti-lock brake control module	• CJB Fuse 29 (15A). • Circuitry. • Anti-lock brake control module.	• Go To Pinpoint Test A .
• Unable to enter self-test.	• Anti-lock brake control module.	• Go To Pinpoint Test B .
• The yellow ABS warning indicator does not self-check	• Circuitry. • Anti-lock brake control module. • Instrument cluster.	• Go To Pinpoint Test J .
• Spongy brake pedal with no	• Air in the brake	• Go To Pinpoint

warning indicator	system. ● Base brake system.	Test K . ● REFER to Section 206-00 .
● Poor vehicle tracking during anti-lock function	● Air in the brake system. ● Hydraulic control unit (HCU). ● Base brake system.	● Go To Pinpoint Test L . ● REFER to Section 206-00 .

Pinpoint Tests

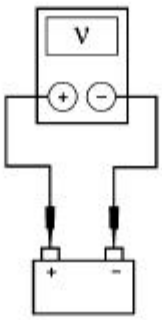
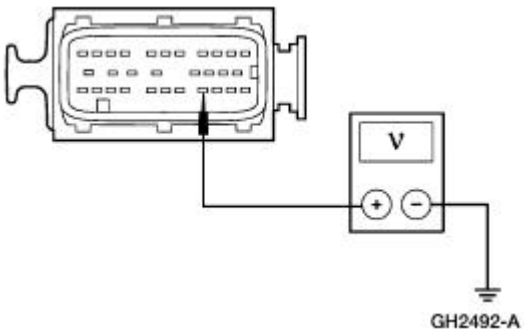
PINPOINT TEST A: NO COMMUNICATION WITH THE ANTI-LOCK BRAKE CONTROL MODULE

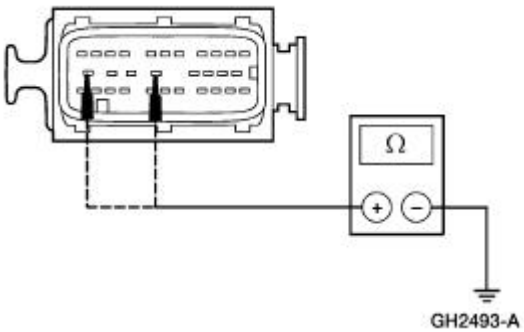
Test Step	Result / Action to Take
A1 CHECK CIRCUIT 601 (LB/PK) FOR AN OPEN	
● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C135. ● Key in ON position. ● Measure the voltage between anti-lock brake control module C135 Pin 8, Circuit 601 (LB/PK), harness side and ground.  GH2492-A ● **Is the voltage greater than 10 volts?**	**Yes** GO to A2 . **No** REPAIR the circuit. REPEAT the self-test.
A2 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS	
● Measure the resistance between anti-lock brake control module C135 Pin 12, Circuit 1205 (BK), harness side and ground; and between anti-lock brake control module C135 Pin 15, Circuit 397 (BK/WH), harness side and ground.  GH2493-A ● **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR the circuit in question. REPEAT the self-test.

PINPOINT TEST B: UNABLE TO ENTER SELF-TEST

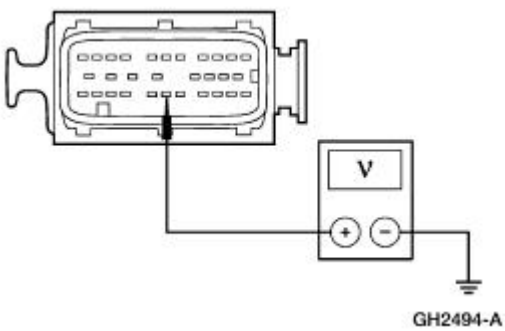
Test Step	Result / Action to Take
B1 CHECK THE COMMUNICATIONS TO THE ANTI-LOCK BRAKE CONTROL MODULE	
• Check the communications to the anti-lock brake control module. • **Does the scan tool communicate with the anti-lock brake control module?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** Go To Pinpoint Test A .

PINPOINT TEST C: DTC B1318, BATTERY VOLTAGE LOW

Test Step	Result / Action to Take
C1 CHECK BATTERY VOLTAGE	
• Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running.  GL1223-A • **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**	**Yes** GO to C2 . **No** REFER to Section 414-00 .
C2 CHECK THE VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE	
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C135. • Key in ON position. • Measure the voltage between anti-lock brake control module C135 Pin 8, Circuit 601 (LB/PK), harness side and ground.  GH2492-A • **Is the voltage greater than 10 volts?**	**Yes** GO to C3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C3 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS	

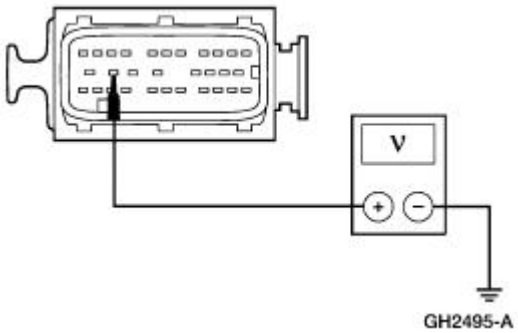
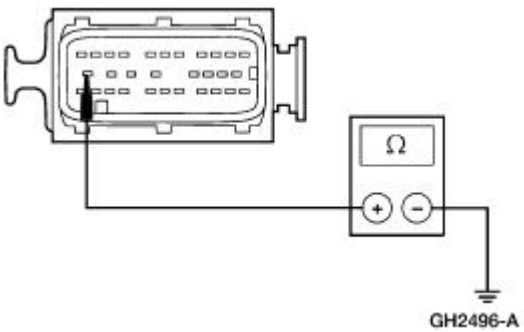
• Measure the resistance between anti-lock brake control module C135 Pin 12, Circuit 1205 (BK), harness side and ground; and between anti-lock brake control module C135 Pin 15, Circuit 397 (BK/WH), harness side and ground.  GH2493-A • **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

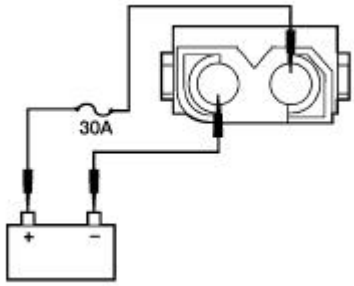
PINPOINT TEST D: DTC B1484, BRAKE PEDAL INPUT OPEN CIRCUIT

Test Step	Result / Action to Take
D1 CHECK THE STOPLAMPS FOR CORRECT OPERATION	
• Depress the brake pedal while checking the stoplamps. • **Do the stop lamps illuminate?**	**Yes** GO to D2 . **No** REFER to Section 417-01 .
D2 CHECK THE BRAKE PEDAL INPUT TO THE ANTI-LOCK BRAKE CONTROL MODULE	
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C135. • Measure the voltage between anti-lock brake control module C135 Pin 6, Circuit 511 (LG), harness side and ground, while depressing and releasing the brake pedal.  GH2494-A • **Is the voltage greater than 10 volts with the brake pedal depressed and zero volts with the brake pedal released?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR Circuit 511 (LG) and Circuit 810 (RD/LG) as necessary. CLEAR the DTCs. REPEAT the self-test.

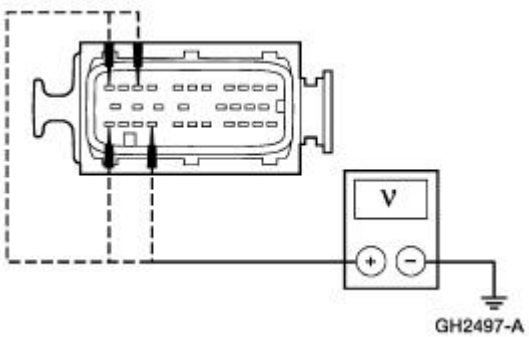
PINPOINT TEST E: DTC C1095, ABS HYDRAULIC PUMP MOTOR FAILURE

Test Step	Result / Action to Take

E1 CHECK THE PUMP MOTOR FOR CONTINUOUS OPERATION ● Check the pump motor for continuous operation. ● **Is the pump motor running continuously?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** GO to E2 .
E2 CHECK CIRCUIT 534 (YE/LG) FOR AN OPEN ● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C135. ● Measure the voltage between anti-lock brake control module C135 Pin 13, Circuit 534 (YE/LG), harness side, and ground.  GH2495-A ● **Is the voltage greater than 10 volts?**	**Yes** GO to E3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E3 CHECK CIRCUIT 1205 (BK) FOR AN OPEN ● Measure the resistance between anti-lock brake control module C135 Pin 12, Circuit 1205 (BK), harness side and ground.  GH2496-A ● **Is the resistance less than 5 ohms?**	**Yes** GO to E4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
E4 CHECK THE PUMP MOTOR FOR OPERATION ● Disconnect: Pump Motor Connector. ● Connect a 30A fused heavy jumper wire between the positive battery post and pump motor connector Pin 1 (component side); and momentarily connect a heavy jumper between negative battery post and pump motor connector Pin 2 (component side).	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** INSTALL a new HCU; REFER to Hydraulic Control Unit . CLEAR the DTCs. REPEAT

 GH1811-A ● **Does the pump motor operate?**	the self-test.

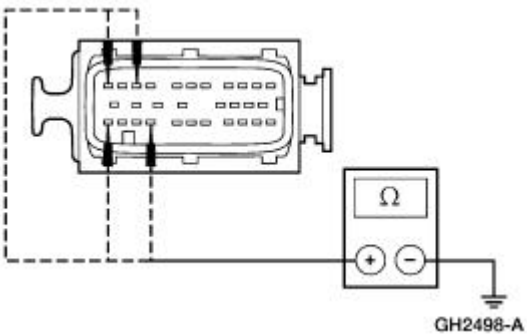
PINPOINT TEST F: DTC C1145 (RF), C1155 (LF), C1165 (RR), C1175 (LR), ANTI-LOCK BRAKE SENSOR INPUT CIRCUIT FAILURE

<table>
<tr><th>Test Step</th><th>Result / Action to Take</th></tr>
<tr><td>F1 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR SHORT TO POWER</td><td></td></tr>
<tr><td>
● Key in OFF position.
● Disconnect: Anti-Lock Brake Control Module C135.
● Key in ON position.
● Measure the voltage between anti-lock brake control module C135 Pins, harness side and ground as follows:
<table>
<tr><th>DTC</th><th>Anti-Lock Brake Control Module C135 Pin</th><th>Circuit</th></tr>
<tr><td>C1145 (RF)</td><td>4</td><td>514 (YE/RD)</td></tr>
<tr><td>C1155 (LF)</td><td>20</td><td>521 (TN/OG)</td></tr>
<tr><td>C1165 (RR)</td><td>1</td><td>494 (TN/LG)</td></tr>
<tr><td>C1175 (LR)</td><td>22</td><td>496 (OG)</td></tr>
</table>

GH2497-A
● Is any voltage present?
</td><td>Yes
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

No
GO to F2 .</td></tr>
<tr><td>F2 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR SHORT TO GROUND</td><td></td></tr>
<tr><td>
● Key in OFF position.
● Measure the resistance between anti-lock brake</td><td>Yes
GO to F4 .</td></tr>
</table>

control module C135 Pins, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C135 Pin	Circuit
C1145 (RF)	4	514 (YE/RD)
C1155 (LF)	20	521 (TN/OG)
C1165 (RR)	1	494 (TN/LG)
C1175 (LR)	22	496 (OG)



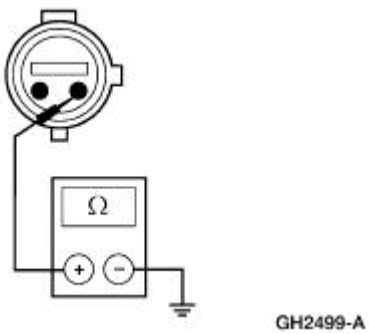
GH2498-A

- **Is the resistance greater than 10,000 ohms?**

No
GO to F3 .

F3 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR FOR A SHORT TO GROUND

- Disconnect: Suspect Anti-Lock Brake Sensor.
- Measure the resistance between suspect anti-lock brake sensor Pin 1 (component side) and ground.



GH2499-A

- **Is the resistance greater than 10,000 ohms?**

Yes
If RF, REPAIR Circuit 514 (YE/RD) and Circuit 516 (YE/BK), as necessary. CLEAR the DTCs. REPEAT the self-test. If LF, REPAIR Circuit 521 (TN/OG) and Circuit 522 (TN/BK), as necessary. CLEAR the DTCs. REPEAT the self-test. If RR, REPAIR Circuit 494 (TN/LG) and Circuit 492 (BN), as necessary. CLEAR the DTCs. REPEAT the self-test. If LR, REPAIR Circuit 496 (OG) and Circuit 499 (GY/BK), as necessary. CLEAR the DTCs. REPEAT the self-test.

No
INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

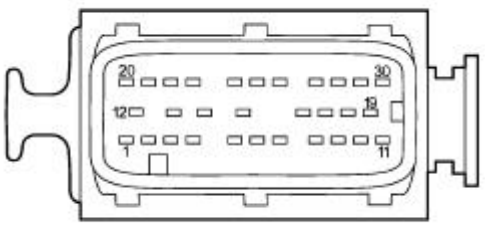
F4 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR FOR AN OPEN

- Key in OFF position.
- Measure the resistance between anti-lock brake control module C135 pins, harness side and suspect anti-lock brake sensor, harness side as follows:

Yes
GO to F5 .

No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-

DTC	Anti-Lock Brake Control Module	Anti-Lock Brake Sensor	Circuit
C1145 (RF)	C135 Pin 4	C160 Pin 1	514 (YE/RD)
C1145 (RF)	C135 Pin 5	C160 Pin 2	516 (YE/BK)
C1155 (LF)	C135 Pin 20	C150 Pin 1	521 (TN/OG)
C1155 (LF)	C135 Pin 21	C150 Pin 2	522 (TN/BK)
C1165 (RR)	C135 Pin 1	C3117 Pin 2	494 (TN/LG)
C1165 (RR)	C135 Pin 3	C3117 Pin 1	492 (BN)
C1175 (LR)	C135 Pin 22	C3116 Pin 2	496 (OG)
C1175 (LR)	C135 Pin 23	C3116 Pin 1	499 (GY/BK)



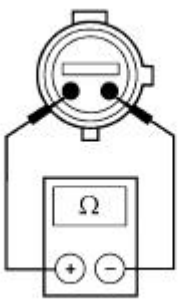
GH2500-A

- **Are the resistances less than 5 ohms?**

test.

F5 CHECK THE ANTI-LOCK BRAKE SENSOR

- Measure the resistance between suspect anti-lock brake sensor Pin 1 (component side) and suspect anti-lock brake sensor Pin 2 (component side).



GH2501-A

- **Is the resistance between 1280 and 1920 (front) or 1830 and 2760 (rear) ohms?**

Yes
INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test.

No
INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST G: DTC C1222, ANTI-LOCK BRAKE SENSOR MISMATCH

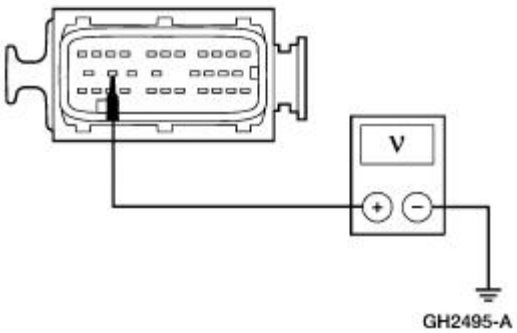
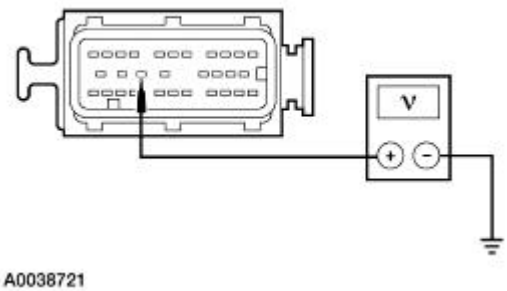
Test Step	Result / Action to Take
G1 CHECK THE VEHICLE COMPONENTS ● Check for correct wheel and tire size, front-to-rear and side-to-side. ● Check for excessive bearing end play. ● Check the anti-lock brake sensor indicator for a deformation or missing teeth. ● **Are the conditions OK?**	**Yes** GO to G2 . **No** REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
G2 TEST DRIVE THE VEHICLE ● Enter the following diagnostic mode on the diagnostic tool: CLEAR the DTCs. ● Key in OFF position. ● Key in ON position. ● Test drive the vehicle over 24 kph (15 mph). ● Enter the following diagnostic mode on the diagnostic tool: Retrieve DTCs. ● **Is DTC C1222 retrieved?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** If another DTC is retrieved, GO to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) index. If no DTCs are retrieved, the system is OK.

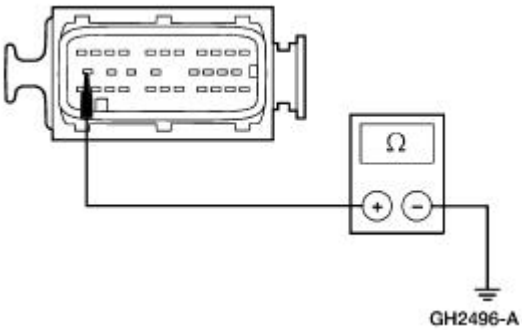
PINPOINT TEST H: DTC C1233 (LF), C1234 (RF), C1235 (RR), C1236 (LR), ANTI-LOCK BRAKE SENSOR INPUT SIGNAL MISSING

Test Step	Result / Action to Take
H1 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR ● Check the suspect anti-lock brake sensor mounting. ● Check the suspect anti-lock brake sensor for excessive dirt build up, obstructions, and damage. ● **Is the suspect anti-lock brake sensor and mounting OK?**	**Yes** GO to H2 . **No** REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
H2 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR INDICATOR ● Check the suspect anti-lock brake sensor indicator for corrosion, nicks, bridged teeth, damaged teeth, correct mounting, and alignment with the anti-lock brake sensor. ● Check the air gap and bearing end play. ● **Is the suspect anti-lock brake sensor indicator OK?**	**Yes** GO to H3 . **No** INSTALL a new anti-lock brake sensor indicator; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.
H3 CHECK THE ANTI-LOCK BRAKE SENSOR OUTPUT ● Key in ON position. ● Enter the following diagnostic mode on the diagnostic tool: CLEAR the DTCs.. ● Key in OFF position. ● Key in ON position.	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test.

• Have an assistant monitor the anti-lock brake control module PIDs LF_WSPD, RF_WSPD, LR_WSPD, and RR_WSPD while driving at various speeds. • **NOTE:** The vehicle must be driven 16 km/h (10 miles) during this test step. • Test drive the vehicle for 16 kmh (10 miles). • **Are the anti-lock brake control module PIDs approximately the same at all times?**	**No** INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST I: ABS VALVE POWER RELAY CIRCUIT FAILURE

Test Step	Result / Action to Take
I1 CHECK CIRCUIT 534 (YE/LG) FOR AN OPEN	**Yes** GO to I2 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C135. • Measure the voltage between anti-lock brake control module C135 Pin 13, Circuit 534 (YE/LG), harness side and ground.  GH2495-A • **Is the voltage greater than 10 volts?**	
I2 CHECK CIRCUIT 532 (OG/YE) FOR AN OPEN	**Yes** REPAIR the open in Circuit 532 (OG/YE). CLEAR the DTCs. REPEAT the self-test. **No** GO to I3 .
• Key in OFF position. • Key in ON position. • Measure the voltage between anti-lock brake control module C135 Pin 14, Circuit 532 (OG/YE), harness side and ground.  A0038721 • **Is the voltage less than 5 volts?**	
I3 CHECK CIRCUIT 1205 (BK) FOR AN OPEN	**Yes** INSTALL a new anti-lock brake control module. REFER to Module in this section. CLEAR the DTCs. REPEAT the self-test.
• Measure the resistance between anti-lock brake control module C135 Pin 12, Circuit 1205 (BK), harness side and ground.	

 ● **Is the resistance less than 5 ohms?**	**No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST J: THE YELLOW ABS WARNING INDICATOR DOES NOT SELF-CHECK

Test Step	Result / Action to Take
J1 CHECK THE ABS WARNING INDICATOR CIRCUITRY	
● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C135. ● Key in ON position. ● Depress and release the shorting bar connector internal to the anti-lock brake control module C135, harness side, while checking the yellow ABS warning indicator in the instrument cluster. ● **Does the yellow ABS indicator illuminate with the shorting bar released and turn OFF with the shorting bar depressed?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . TEST the system for normal operation. **No** REFER to Section 413-01 .

PINPOINT TEST K: SPONGY BRAKE PEDAL WITH NO WARNING INDICATOR

Test Step	Result / Action to Take
K1 CHECK THE VEHICLE COMPONENTS	
● Check the brake pedal and power booster/brake master cylinder for correct attachment. ● **Are the components OK?**	**Yes** GO to K2 . **No** REPAIR as necessary. TEST the system for normal operation.
K2 BLEED THE BRAKE SYSTEM	
● Bleed the brake system; Refer to Section 206-00 . ● Check for spongy brake pedal. ● **Is the brake pedal spongy?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** The brake system is OK. TEST the system for normal operation.

PINPOINT TEST L: POOR VEHICLE TRACKING DURING ANTI-LOCK

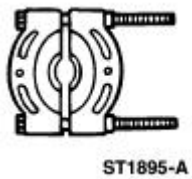
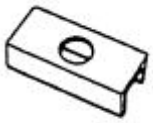
FUNCTION

Test Step	Result / Action to Take
L1 BLEED THE BRAKE SYSTEM • Bleed the brake system. Refer to Section 206-00 . • Check for vehicle tracking poorly. • **Does the vehicle track poorly?**	**Yes** GO to L2 . **No** The brake system is OK. TEST the system for normal operation.
L2 CHECK THE LF ABS VALVE OPERATION • Lift the vehicle and rotate all the wheels to make sure they rotate freely (the vehicle must be in neutral). • **NOTE:** Trigger must be depressed twice. Each press will run the pump motor for two seconds. • Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the LF wheel while the pump motor is running. • **Does the LF wheel rotate?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** GO to L3 .
L3 CHECK THE LF ABS VALVE RELEASE • Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command LF INLET and LF OUTLET. • **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. • Have an assistant rotate the LF wheel immediately after depressing trigger. • **Does the LF wheel rotate?**	**Yes** GO to L4 . **No** GO to L8 .
L4 CHECK THE RF ABS VALVE OPERATION • **NOTE:** Trigger must be depressed twice. Each press will run the pump motor for two seconds. • Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the RF wheel while the pump motor is running. • **Does the RF wheel rotate?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** GO to L5 .
L5 CHECK THE RF ABS VALVE RELEASE • Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command RF INLET and RF OUTLET. • **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. • Have an assistant rotate the RF wheel immediately after depressing trigger. • **Does the RF wheel rotate?**	**Yes** GO to L6 . **No** GO to L8 .
L6 CHECK THE REAR ABS VALVE OPERATION • **NOTE:** Trigger must be depressed twice.Each press will run the pump motor for	**Yes** INSTALL a new HCU; REFER to

two seconds. ● Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. ● Apply moderate brake pedal effort. ● Have an assistant attempt to rotate the LR and RR wheels while the pump motor is running. ● **Does the LR or RR wheel rotate?**	Hydraulic Control Unit . TEST the system for normal operation. **No** GO to L7 .
L7 CHECK THE REAR ABS VALVE RELEASE ● Apply moderate brake pedal effort. ● Trigger the anti-lock brake control module active command R INLET and R OUTLET. ● **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. ● Have an assistant rotate the LR and RR wheels immediately after depressing trigger. ● **Does the LR or RR wheel rotate?**	**Yes** The ABS system is operating correctly. **No** GO to L8 .
L8 CHECK FOR DTCS ● Carry out the anti-lock brake control module self-test. ● **Are any DTCs retrieved?**	**Yes** GO to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index. **No** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation.

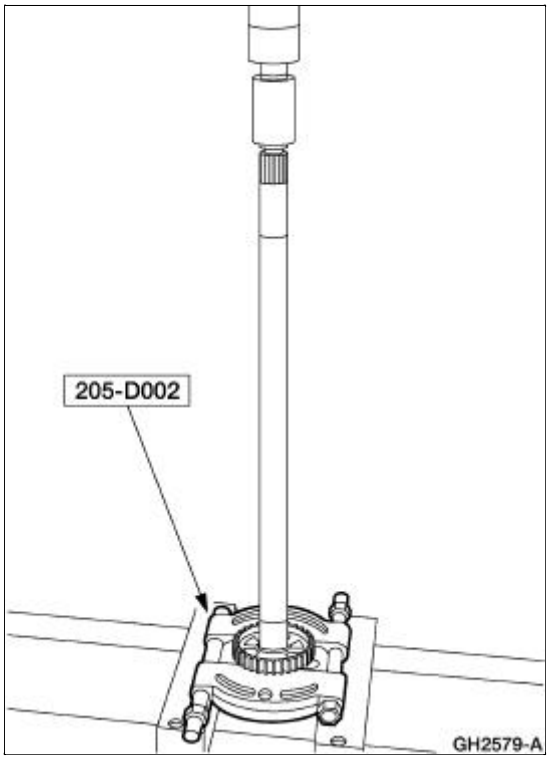
Sensor Indicator —Rear

Special Tool(s)

 ST1895-A	Pinion Bearing Cone Remover 205-D002 (D79P-4621A)
 ST1254-A	Axle Bearing/Seal Plate 205-090 (T75L-1165-B)
ST1713-A	Sensing Ring Replacer 206-041 (T89P-20202-A)

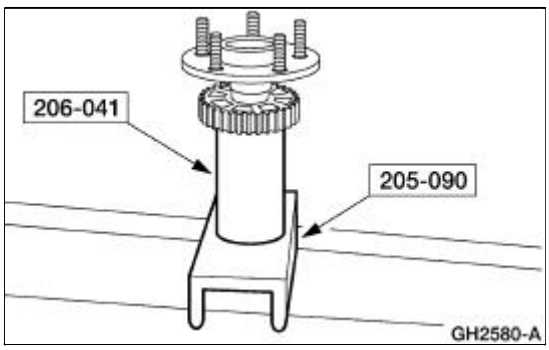
Removal

1. Remove the rear axle shaft bearing, refer to Section 205-02A or Section 205-02B .
2. Using the special tool, remove the anti-lock brake sensor indicator from the axle shaft.

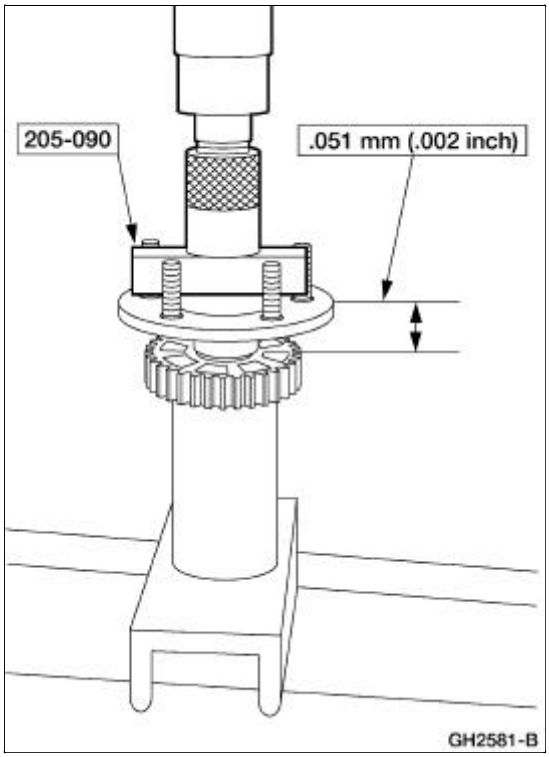


Installation

1. Using the special tools, align the rear anti-lock brake sensor indicator to the rear axle shaft.



2. Using the special tools, press the rear anti-lock brake sensor on the rear axle shaft to specification.

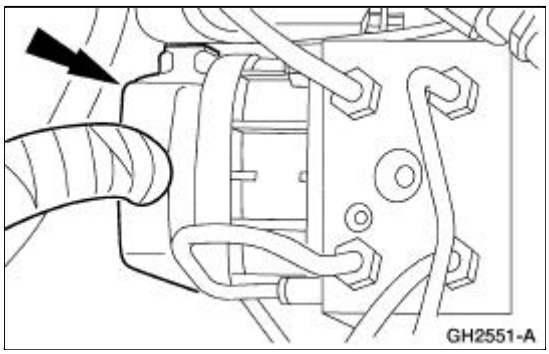


3. Install the rear axle shaft bearing, refer to Section 205-02A .

Hydraulic Control Unit

Removal

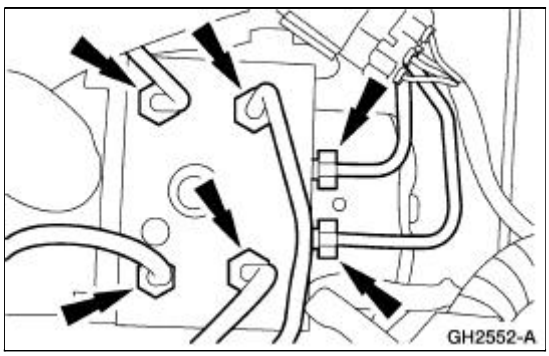
1. Disconnect the battery ground cable(14301).
2. Disconnect the anti-lock-brake control module electrical connector.



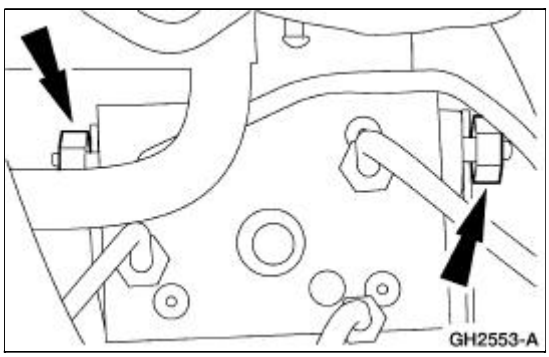
3. **NOTE:** The 4 wheel anti-lock brake system (4WABS) with traction control is shown , the 4WABS without traction control system is similar with one less hydraulic line.

   NOTE: Plug brake lines to prevent any brake fluid loss.

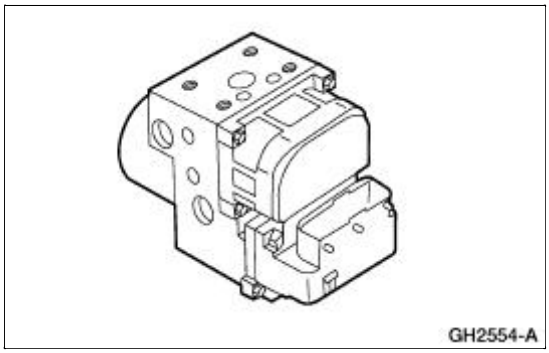
   Disconnect the brake lines from the hydraulic control unit (HCU).



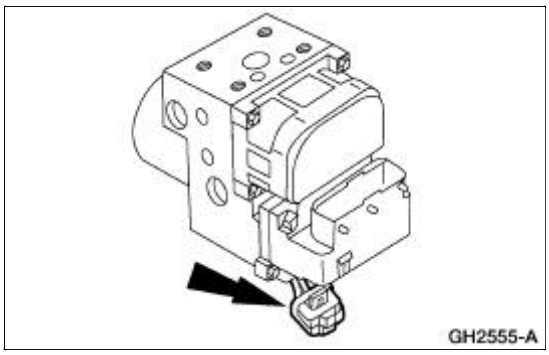
4. Remove the HCU bracket nuts to HCU.



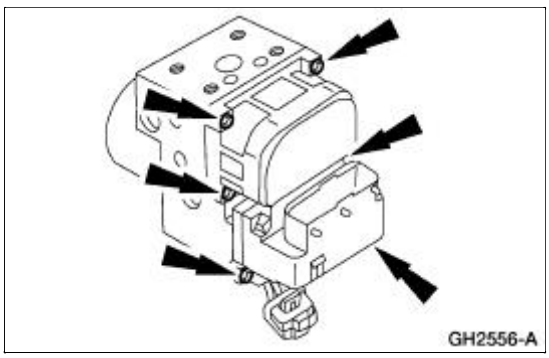
5. Remove the HCU.



6. Remove the pump motor electrical connector.



7. Remove the anti-lock-brake control module screws.

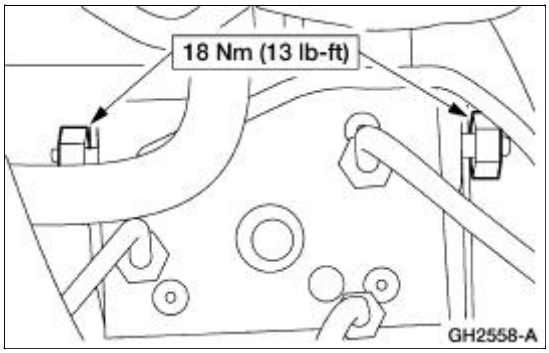


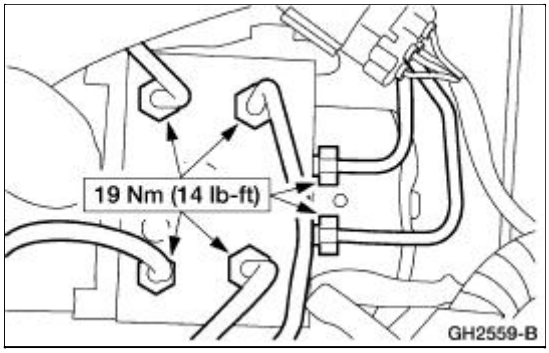
8. Remove the anti-lock-brake control module from the HCU.

Installation

1. **NOTE:** The brake system must be bled after the HCU is installed or replaced. Refer to Section 206-00 .

   To install, reverse the removal procedure.

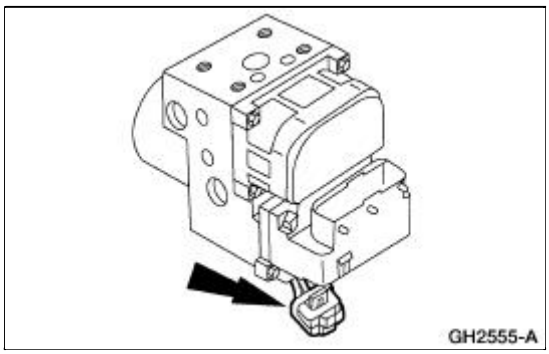

18 Nm (13 lb-ft)
GH2558-A


19 Nm (14 lb-ft)
GH2559-B

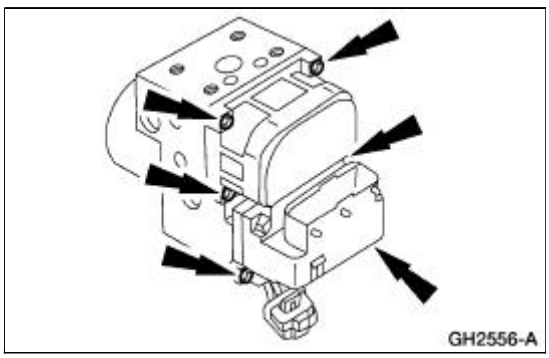
Module

Removal

1. Remove the hydraulic control unit (HCU). Refer to Hydraulic Control Unit .
2. Remove the pump motor electrical connector.



3. Remove the anti-lock-brake control module screws.



4. Remove the anti-lock-brake control module from the HCU.

Installation

1. **NOTE:** The brake system must be bled after the HCU is installed or replaced. Refer to Section 206-00 .

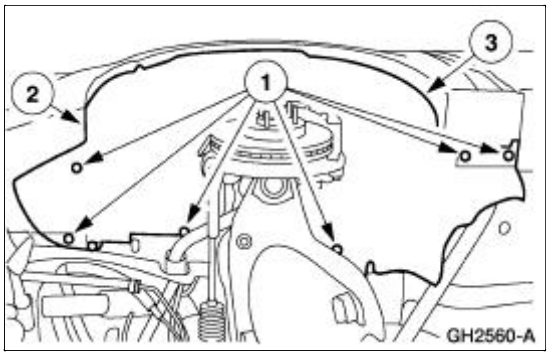
   To install, reverse the removal procedure.

Sensor —Front

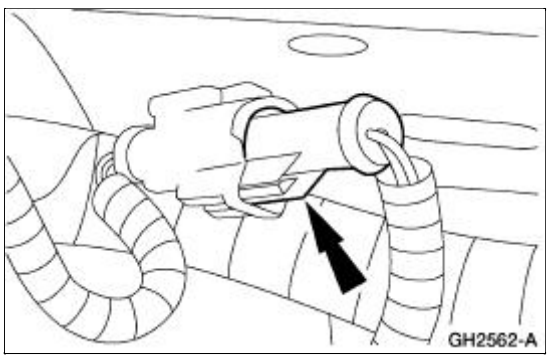
Removal

1. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .

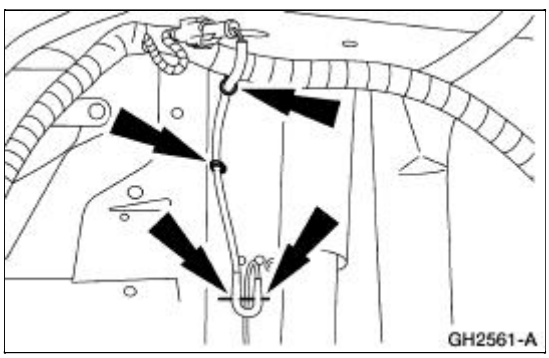
2. Remove the inner fender splash shield.
    1. Remove the inner fender splash shield push pins.
    2. Remove the inner fender splash shield screw.
    3. Remove the inner fender splash shield.



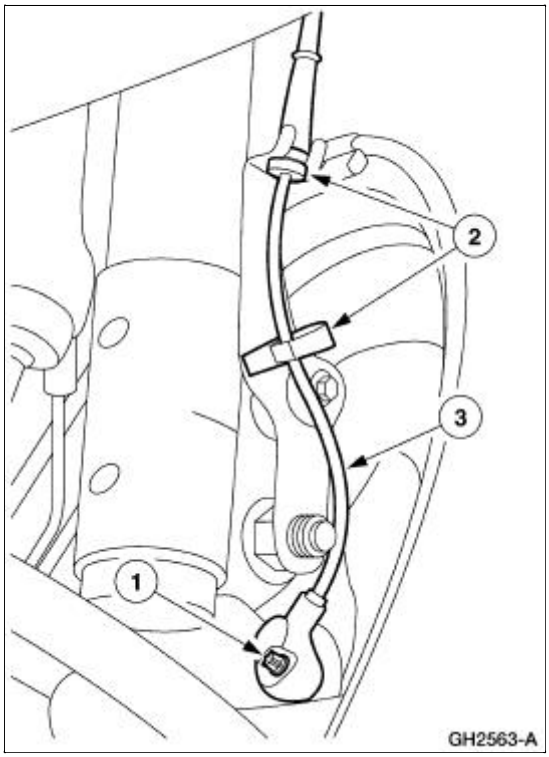
3. Remove the front anti-lock brake sensor electrical connector.



4. Remove the front anti-lock brake sensor harness from the anti-lock brake sensor harness clips.

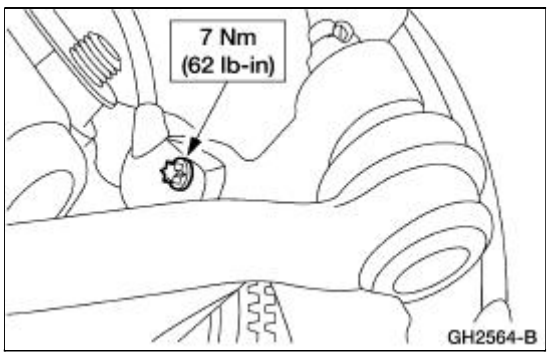


5. Remove the front anti-lock brake sensor.
    1. Remove the front anti-lock brake sensor bolt.
    2. Remove the anti-lock brake sensor harness from the harness clips.
    3. Remove the front anti-lock brake sensor.



Installation

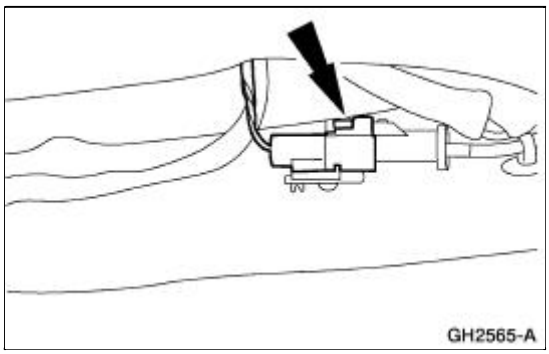
1. To install, reverse the removal procedure.



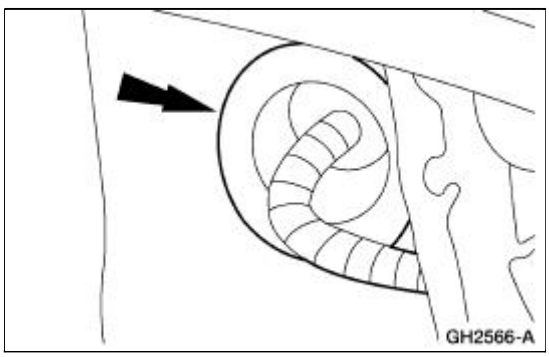
Sensor —Rear

Removal

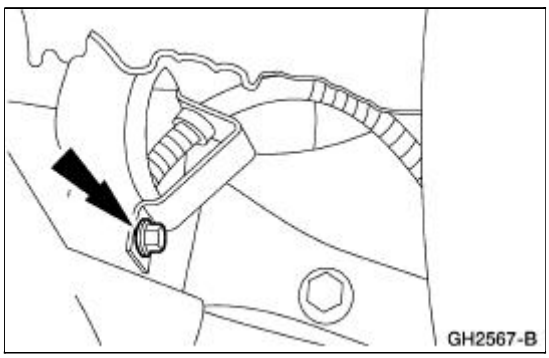
1. Remove the rear passenger seat.
2. Disconnect the rear anti-lock brake sensor electrical connector.



3. Raise and support the vehicle. For additional information, refer to Section 100-02 .
4. Remove the rear anti-lock brake sensor harness from the floor pan.



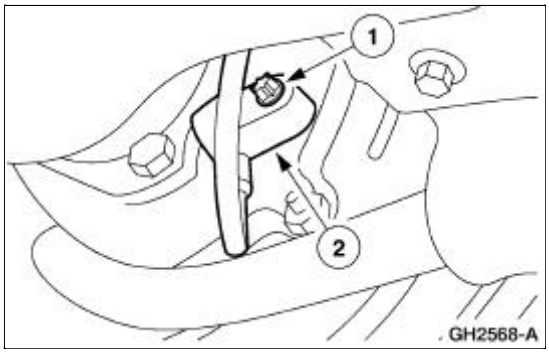
5. Remove the anti-lock brake sensor harness bracket bolt.



6. **NOTE:** The sensor may be siezed to the axle. Use Rust Penetrant and Inhibitor F2AZ-19A501-A meeting Ford specification ESR-M99C56-A to loosen the sensor for removal.

   Remove the rear anti-lock brake sensor.

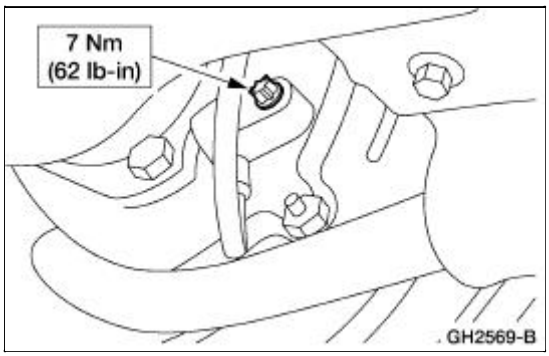
1. Remove the rear anti-lock brake sensor bolt.
2. Remove the rear anti-lock brake sensor.



Installation

1. **NOTE:** Be sure to apply High Temperature Nickel Anti-Sieze Lubricant F6AZ-9L494-AA meeting Ford specification ESE-M124A-A to the sensor body where it will make contact when installed.

   To install, reverse the removal procedure.



Torque Specifications

Description	Nm	lb-ft	lb-in
Anti-lock brake control module screws	3	—	26
Brake line fittings to hydraulic control unit	19	14	—
Front anti-lock brake sensor bolt	7	—	62
Hydraulic control unit to mounting bracket nuts	18	13	—
Rear anti-lock brake sensor bolt	7	—	62

Anti-Lock Control —Traction Control

The four wheel anti-lock brake system (4WABS) with traction control consists of the following components:

- anti-lock brake control module (2C346)
- front anti-lock brake sensor (2C204)/(2C205)
- front anti-lock brake sensor indicator (2C182)
- hydraulic control unit (2C286)
- powertrain control module (12A650)
- rear anti-lock brake sensor (2C190)/(2C216)
- rear anti-lock brake sensor indicator (2C189)
- traction control switch
- yellow anti-lock brake system (ABS) warning indicator

Anti-Lock Control —Traction Control

Refer to Wiring Diagrams Cell 42 , Anti-Lock Brake System for schematic and connector information.

Special Tool(s)

ST2332-A	Worldwide Diagnostic System (WDS) 418-F224, New Generation STAR (NGS) Tester 418-F052, or equivalent scan tool
ST1137-A	73 Digital Multimeter or equivalent 105-R0051

Principles of Operation

The anti-lock-brake control module receives wheel speed readings from each anti-lock brake sensor and processes this information to determine if an ABS event is necessary. The anti-lock brake sensor electrically senses each tooth of the anti-lock brake sensor indicators as it passes through the anti-lock brake sensor's magnetic field.

The anti-lock brake control module continuously monitors and compares the rotational speed of each wheel and, when it detects an impending wheel lock, modulates brake pressure to the appropriate brake caliper. This is accomplished by triggering the hydraulic control unit (HCU) to open and close the appropriate solenoid valves. Once the affected wheel returns to normal speed, the anti-lock brake control module returns the solenoid valves to their normal position, and normal (base) braking resumes.

The anti-lock brake control module is self-monitoring. When the ignition switch is turned to the RUN position, the anti-lock brake control module will do a preliminary electrical check, and at approximately 12 km/h (8 mph) the pump motor is turned on for approximately one half-second. Also during all phases of operation the anti-lock brake control module (after the vehicle is in motion) checks for correct operation of the anti-lock brake sensors. Any malfunction of the ABS will cause the ABS to shut off and ABS warning indicator to illuminate; normal power assisted braking, however, remains.

The ABS control module has the ability to store multiple DTCs in memory.

The traction control system controls wheelspin by modulating the engine torque by communicating to the powertrain control module (PCM) and by applying, then releasing, the appropriate brake to restore traction when one or both drive wheels lose traction and begin to spin during acceleration.

The traction control system can be disabled by depressing the traction control switch. The traction control system will reset and return to normal traction assist when the ignition switch is cycled or when the traction control switch is depressed again.

Inspection and Verification

1. Verify the customer concern by operating the system.

2. Visually inspect for obvious signs of mechanical and electrical damage.

Visual Inspection Chart

Mechanical	Electrical
● Low brake fluid ● Anti-lock brake sensor ● Anti-lock brake sensor indicator ● Base brake system ● Wheel bearings	● Central junction box (CJB) Fuse: ■ 5 (15A) ■ 15 (10A) ■ 29 (15A) ■ 33 (15A) ■ 35 (15A) ● Battery junction box (BJB) Fuse: ■ ABS 1 (50A) ■ ABS 2 (20A) ● Circuitry ● Damaged or corroded connectors ● ABS warning indicator ● Loose grounds

3. If the concern remains after the inspection, connect the scan tool to the data link connector (DLC) located beneath the instrument panel and select the vehicle to be tested from the scan tool menu. If the scan tool does not communicate with the vehicle:
    1. Check that the program card is correctly installed.
    2. Check the connections to the vehicle.
    3. Check the ignition switch position.

4. If the scan tool still does not communicate with the vehicle, refer to the scan tool manual.

5. Carry out the DATA LINK DIAGNOSTIC TEST. If the scan tool responds with:
    1. CKT914, CKT915 or CKT70 = ALL ECUS NO RESP/NOT EQUIP, refer to Section 418-00.
    2. NO RESP/NOT EQUIP for the anti-lock brake control module, Go To Pinpoint Test A .
    3. SYSTEM PASSED, retrieve and record the continuous diagnostic trouble codes (DTCs), erase the continuous DTCs and carry out self-test diagnostics for the anti-lock brake control module.

6. If the DTCs retrieved are related to the concern, go to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index to continue diagnostics.

7. If no DTCs related to the concern are retrieved, GO to Symptom Chart to continue diagnostics.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

NOTE: If a wheel speed signal fault or a pump motor fault is detected, the yellow ABS warning indicator cannot be reset with the key OFF and key ON method. The vehicle must be driven over 12 km/h (8 mph) for the anti-lock brake control module to do a re-check of the system before the yellow ABS warning indicator is turned OFF.

Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index

DTC	Description	Source	Action
B1318	Battery Voltage Low	ABS/TC	Go To Pinpoint Test C .
B1342	ECU Is Defective	ABS/TC	INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test.
B1484	Brake Pedal Input Open Circuit	ABS/TC	Go To Pinpoint Test D .
B1596	Repair Continuous Codes	ABS/TC	REPAIR the DTCs retrieved.
C1095	ABS Hydraulic Pump Motor Circuit Failure	ABS/TC	Go To Pinpoint Test E .
C1145	RF Anti-Lock Brake Sensor Input Circuit Failure	ABS/TC	Go To Pinpoint Test F .
C1155	LF Anti-Lock Brake Sensor Input Circuit Failure	ABS/TC	Go To Pinpoint Test F .
C1165	RR Anti-Lock Brake Sensor Input Circuit Failure	ABS/TC	Go To Pinpoint Test F .
C1175	LR Anti-Lock Brake Sensor Input Circuit Failure	ABS/TC	Go To Pinpoint Test F .
C1222	Anti-Lock Brake Sensor Mismatch	ABS/TC	Go To Pinpoint Test G .
C1233	LF Anti-Lock Brake Sensor Input Signal Missing	ABS/TC	Go To Pinpoint Test H .
C1234	RF Anti-Lock Brake Sensor Input Signal Missing	ABS/TC	Go To Pinpoint Test H .
C1235	RR Anti-Lock Brake Sensor Input Signal Missing	ABS/TC	Go To Pinpoint Test H .
C1236	LR Anti-Lock Brake Sensor Input Signal Missing	ABS/TC	Go To Pinpoint Test H .
C1266	ABS Valve Power Relay Circuit Failure	ABS/TC	INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test.
C1805	Mismatched PCM and/or Anti-Lock Brake Control Module	ABS/TC	CLEAR the DTCs. RETRIEVE the DTCs. If DTC C1805 is retrieved, check the PCM and Anti-Lock Brake Control Module is for the correct vehicle. INSTALL a new PCM or anti-lock brake control module as necessary. CLEAR the DTCs. REPEAT the self-test.
U1009	SCP (J1850) Invalid or Missing Data for Engine Torque	ABS/TC	CARRY OUT the PCM self-test.
U1027	SCP (J1850) Invalid or Missing Data for Engine RPM	ABS/TC	CARRY OUT the PCM self-test.
U1059	SCP (J1850) Invalid or Missing Data for Transmission/Transaxle/PRNDL	ABS/TC	CARRY OUT the PCM self-test.
U1083	SCP (J1850) Invalid or Missing Data for Engine Systems	ABS/TC	CARRY OUT the PCM self-test.
U1262	SCP (J1850) Communication Bus Fault	ABS/TC	REFER to Section 418-00 .

Anti-Lock Brake Control Module Parameter Identification (PID) Index

Anti-Lock Brake Control Module Parameter Identification (PID) Index

PID	Description	Expected Value
CCNTABS	Number of Continuous DTCS in the Anti-Lock Brake Control Module	one count per bit
BOO_ABS	Brake Switch Input	OFF, ON
PMP_MTR	ABS Pump Motor	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
VLV_CTR	ABS Valve Control Relay	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
LF_WSPD	LF Wheel Speed	0-255 MPH
RF_WSPD	RF Wheel Speed	0-255 MPH
LR_WSPD	LR Wheel Speed	0-255 MPH
RR_WSPD	RR Wheel Speed	0-255 MPH
ABSLF_I	LF ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSLF_O	LF ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSRF_I	RF ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSRF_O	RF ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSLR_I	LR ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSLR_O	LR ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSRR_I	RR ABS Inlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
ABSRR_O	RR ABS Outlet Valve	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
LF_TC_P	LF Traction Control Priming Valve	OFF, ON
RF_TC_P	RF Traction Control Priming Valve	OFF, ON
LR_TC_P	LR Traction Control Priming Valve	OFF, ON
RR_TC_P	RR Traction Control Priming Valve	OFF, ON
LF_TC_S	LF Traction Control Switching	OFF, ON

	Valve	
RF_TC_S	RF Traction Control Switching Valve	OFF, ON
LR_TC_S	LR Traction Control Switching Valve	OFF, ON
RR_TC_S	RR Traction Control Switching Valve	OFF, ON
T/ALVAL	Left Traction Control Valve Output State	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG
T/ARVAL	Right Traction Control Valve Output State	OFF---, OFFO--, OFF-B-, OFF--G, OFFO-G, OFF-BG, OFFOBG, ON---, ONO--, ON-B-, ON--G, ONO-G, ON-BG, ONOBG

Anti-Lock Brake Control Module Active Command Index

Anti-Lock Brake Control Module Active Command Index

Active Command	Display	Action
ABS OUTPUT CONTROL	ABS POWER	OFF, ON
	DSBL TOG	OFF, ON
	LF INLET	OFF, ON
	LF OUTLET	OFF, ON
	RF INLET	OFF, ON
	RF OUTLET	OFF, ON
	LR INLET	OFF, ON
	LR OUTLET	OFF, ON
	RR INLET	OFF, ON
	RR OUTLET	OFF, ON
TRACTION CONTROL PRIMARY AND SWITCHING VALVE CONTROL	LF TC PRV	OFF, ON
	LF TC SWV	OFF, ON
	RF TC PRV	OFF, ON
	RF TC SWV	OFF, ON
	LR TC PRV	OFF, ON
	LR TC SWV	OFF, ON
	RR TC PRV	OFF, ON
	RR TC SWV	OFF, ON

Symptom Chart

Symptom Chart

NOTE: Refer to the wiring diagrams for connector numbers stated in the pinpoint

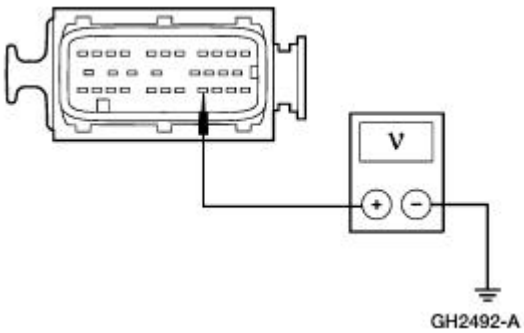
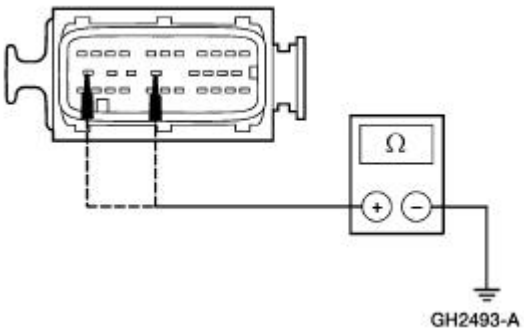
test.

Condition	Possible Sources	Action
● No communication with the anti-lock brake control module	● CJB Fuse 29 (15A). ● Circuitry. ● Anti-lock brake control module.	● Go To Pinpoint Test A .
● Unable to enter self-test	● Anti-lock brake control module.	● Go To Pinpoint Test B .
● The yellow ABS warning indicator does not self-check	● Circuitry. ● Anti-lock brake control module. ● Instrument cluster.	● Go To Pinpoint Test I .
● Spongy brake pedal with no warning indicator	● Air in the brake system. ● Base brake system. ● Hydraulic control unit (HCU).	● Go To Pinpoint Test J . ● REFER to Section 206-00 .
● Poor vehicle tracking during anti-lock function	● Air in the brake system. ● Hydraulic control unit (HCU). ● Base brake system.	● Go To Pinpoint Test K . ● REFER to Section 206-00 .
● The traction control is inoperative—does not operate correctly	● CJB 5 (15A). ● Circuitry. ● Traction control switch. ● Instrument cluster. ● Anti-lock brake control module.	● Go To Pinpoint Test L .
● The traction control indicator is inoperative—traction control switch	● Circuitry. ● Traction control switch. ● Instrument cluster.	● Go To Pinpoint Test M .

Pinpoint Tests

PINPOINT TEST A: NO COMMUNICATION WITH THE ANTI-LOCK BRAKE CONTROL MODULE

Test Step	Result / Action to Take
A1 CHECK CIRCUIT 601 (LB/PK) FOR AN OPEN	
● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C141. ● Key in ON position. ● Measure the voltage between anti-lock brake control module C141 Pin 8, Circuit 601 (LB/PK), harness side and ground.	**Yes** GO to A2 . **No** REPAIR the circuit.

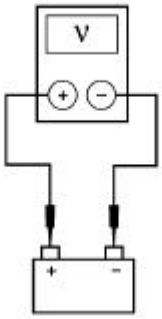
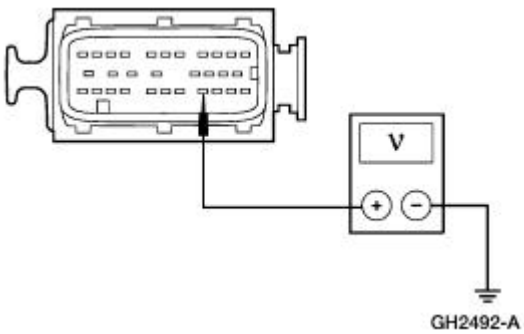
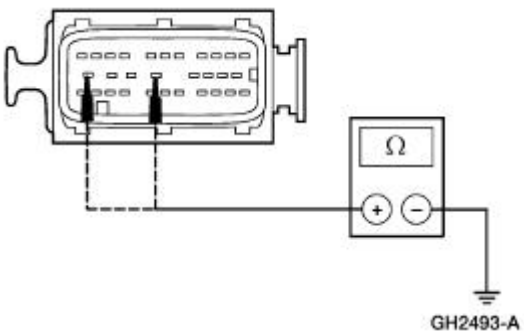
 GH2492-A ● **Is the voltage greater than 10 volts?**	REPEAT the self-test.
A2 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS	
● Measure the resistance between anti-lock brake control module C141 Pin 12, Circuit 1205 (BK), harness side and ground; and between anti-lock brake control module C141 Pin 15, Circuit 397 (BK/WH), harness side and ground.  GH2493-A ● **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR the circuit in question. REPEAT the self-test.

PINPOINT TEST B: UNABLE TO ENTER SELF-TEST

Test Step	Result / Action to Take
B1 CHECK THE COMMUNICATIONS TO THE ANTI-LOCK BRAKE CONTROL MODULE	
● Check the communications to the anti-lock brake control module. ● **Does the scan tool communicate with the anti-lock brake control module?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** Go To Pinpoint Test A .

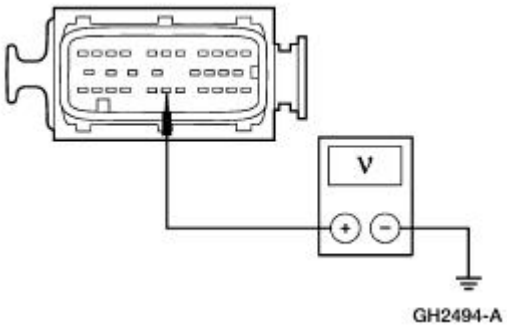
PINPOINT TEST C: DTC B1318, BATTERY VOLTAGE LOW

Test Step	Result / Action to Take
C1 CHECK BATTERY VOLTAGE	
● Measure the battery voltage between the positive and negative battery posts with the key ON engine OFF (KOEO), and with the engine running.	**Yes** GO to C2 . **No** REFER to Section

 GL1223-A ● **Is the battery voltage between 10 and 13 volts with KOEO, and between 11 and 17 volts with the engine running?**	414-00 .
C2 CHECK THE VOLTAGE TO THE ANTI-LOCK BRAKE CONTROL MODULE	
● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C141. ● Key in ON position. ● Measure the voltage between anti-lock brake control module C141 Pin 8, Circuit 601 (LB/PK), harness side and ground.  GH2492-A ● **Is the voltage greater than 10 volts?**	**Yes** GO to C3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
C3 CHECK THE ANTI-LOCK BRAKE CONTROL MODULE GROUNDS	
● Measure the resistance between anti-lock brake control module C141 Pin 12, Circuit 1205 (BK), harness side and ground; and between anti-lock brake control module C141 Pin 15, Circuit 397 (BK/WH), harness side and ground.  GH2493-A ● **Are the resistances less than 5 ohms?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

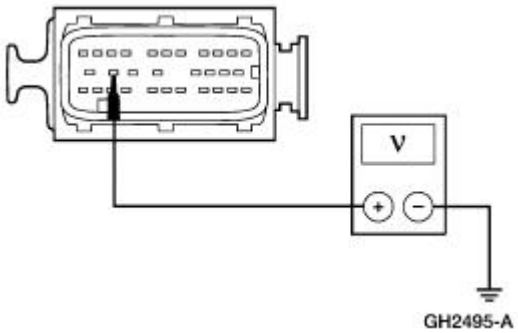
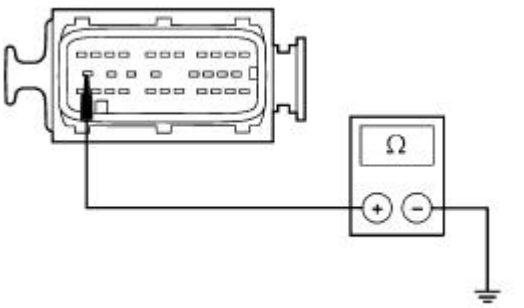
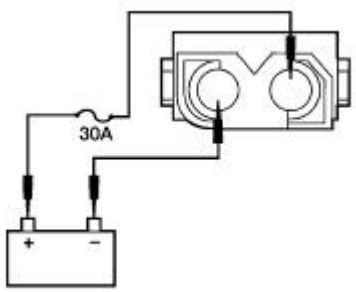
PINPOINT TEST D: DTC B1484, BRAKE PEDAL INPUT OPEN CIRCUIT

Test Step	Result / Action to Take
D1 CHECK THE STOPLAMPS FOR CORRECT OPERATION	

• Depress the brake pedal while checking the stoplamps. • **Do the stop lamps illuminate?**	**Yes** GO to D2 . **No** REFER to Section 417-01 .
D2 CHECK THE BRAKE PEDAL INPUT TO THE ANTI-LOCK BRAKE CONTROL MODULE	
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C141. • Measure the voltage between anti-lock brake control module C141 Pin 6, Circuit 511 (LG), harness side and ground, while depressing and releasing the brake pedal.  GH2494-A • **Is the voltage greater than 10 volts with the brake pedal depressed and zero volts with the brake pedal released?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** REPAIR Circuit 511 (LG) and Circuit 810 (RD/LG) as necessary. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST E: DTC C1095, ABS HYDRAULIC PUMP MOTOR FAILURE

Test Step	Result / Action to Take
E1 CHECK THE PUMP MOTOR FOR CONTINUOUS OPERATION	
• Check the pump motor for continuous operation. • **Is the pump motor running continuously?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** GO to E2 .
E2 CHECK CIRCUIT 534 (YE/LG) FOR AN OPEN	
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C141. • Measure the voltage between anti-lock brake control module C141 Pin 13, Circuit 534 (YE/LG), harness side, and ground.	**Yes** GO to E3 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.

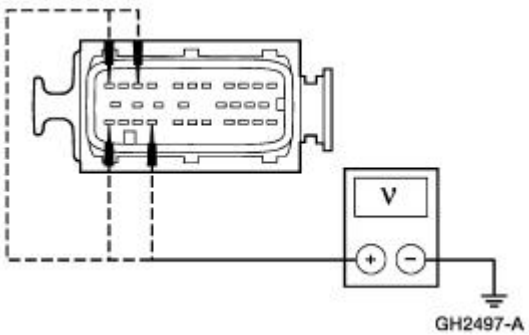
 GH2495-A ● **Is the voltage greater than 10 volts?**	
E3 CHECK CIRCUIT 1205 (BK) FOR AN OPEN	**Yes** GO to E4 . **No** REPAIR the circuit. CLEAR the DTCs. REPEAT the self-test.
● Measure the resistance between anti-lock brake control module C141 Pin 12, Circuit 1205 (BK), harness side and ground.  GH2496-A ● **Is the resistance less than 5 ohms?**	
E4 CHECK THE PUMP MOTOR FOR OPERATION	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** INSTALL a new HCU; REFER to Hydraulic Control Unit . CLEAR the DTCs. REPEAT the self-test.
● Disconnect: Pump Motor Connector. ● Connect a 30A fused heavy jumper wire between the positive battery post and pump motor connector Pin 1 (component side); and momentarily connect a heavy jumper between negative battery post and pump motor connector Pin 2 (component side).  GH1811-A ● **Does the pump motor operate?**	

PINPOINT TEST F: DTC C1145 (RF), C1155 (LF), C1165 (RR), C1175 (LR), ANTI-LOCK BRAKE SENSOR INPUT CIRCUIT FAILURE

Test Step	Result / Action to Take
F1 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR SHORT TO POWER	
● Key in OFF position. ● Disconnect: Anti-Lock Brake Control Module C141. ● Key in ON position.	**Yes** REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-

- Measure the voltage between anti-lock brake control module C141 Pins, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C141 Pin	Circuit
C1145 (RF)	4	514 (YE/RD)
C1155 (LF)	20	521 (TN/OG)
C1165 (RR)	1	494 (TN/LG)
C1175 (LR)	22	496 (OG)



- **Is any voltage present?**

test.

No
GO to F2 .

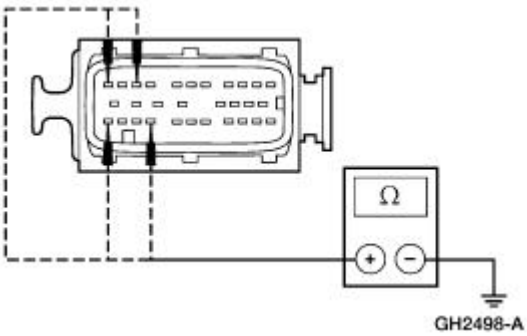
F2 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR SHORT TO GROUND

- Key in OFF position.
- Measure the resistance between anti-lock brake control module C141 Pins, harness side and ground as follows:

DTC	Anti-Lock Brake Control Module C141 Pin	Circuit
C1145 (RF)	4	514 (YE/RD)
C1155 (LF)	20	521 (TN/OG)
C1165 (RR)	1	494 (TN/LG)
C1175 (LR)	22	496 (OG)

Yes
GO to F4 .

No
GO to F3 .

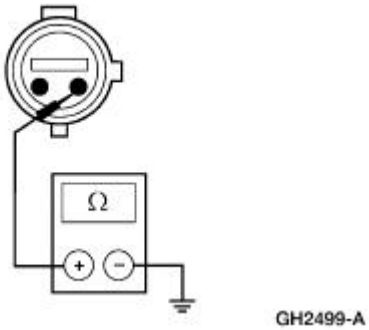


GH2498-A

- **Is the resistance greater than 10,000 ohms?**

F3 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR FOR A SHORT TO GROUND

- Disconnect: Suspect Anti-Lock Brake Sensor.
- Measure the resistance between suspect anti-lock brake sensor Pin 1 (component side) and ground.



GH2499-A

- **Is the resistance greater than 10,000 ohms?**

Yes
If RF, REPAIR Circuit 514 (YE/RD) and Circuit 516 (YE/BK), as necessary. CLEAR the DTCs. REPEAT the self-test. If LF, REPAIR Circuit 521 (TN/OG) and Circuit 522 (TN/BK), as necessary. CLEAR the DTCs. REPEAT the self-test. If RR, REPAIR Circuit 494 (TN/LG) and Circuit 492 (BN), as necessary. CLEAR the DTCs. REPEAT the self-test. If LR, REPAIR Circuit 496 (OG) and Circuit 499 (GY/BK), as necessary. CLEAR the DTCs. REPEAT the self-test.

No
INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

F4 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR CIRCUIT FOR FOR AN OPEN

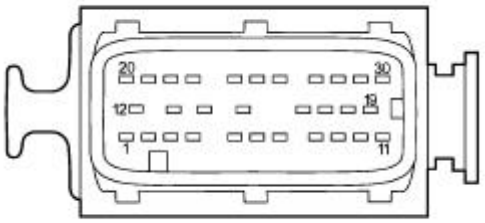
- Key in OFF position.
- Measure the resistance between anti-lock brake control module C141 Pins, harness side and suspect anti-lock brake sensor, harness side as follows:

DTC	Anti-Lock Brake Control Module	Anti-Lock Brake Sensor	Circuit
C1145 (RF)	C141 Pin 4	C145 Pin 1	514 (YE/RD)
C1145 (RF)	C141 Pin 5	C145 Pin 2	516 (YE/BK)
C1155 (LF)	C141 Pin 20	C144 Pin 1	521 (TN/OG)
C1155 (LF)	C141 Pin 21	C144 Pin 2	522 (TN/BK)
C1165 (RR)	C141 Pin 1	C319 Pin 2	494 (TN/LG)
C1165	C141 Pin 3	C319 Pin 1	492 (BN)

Yes
GO to F5 .

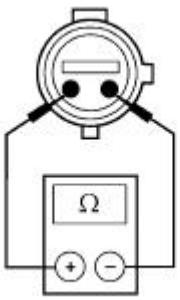
No
REPAIR the circuit in question. CLEAR the DTCs. REPEAT the self-test.

(RR)			
C1175 (LR)	C141 Pin 22	C320 Pin 2	496 (OG)
C1175 (LR)	C141 Pin 23	C320 Pin 1	499 (GY/BK)



GH2500-A

- **Are the resistances less than 5 ohms?**

F5 CHECK THE ANTI-LOCK BRAKE SENSOR	
• Measure the resistance between suspect anti-lock brake sensor pin 1 (component side) and suspect anti-lock brake sensor pin 2 (component side).  GH2501-A • **Is the resistance between 1280 and 1920 (front) or 1830 and 2760 (rear) ohms?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST G: DTC C1222, ANTI-LOCK BRAKE SENSOR MISMATCH

Test Step	Result / Action to Take
G1 CHECK THE VEHICLE COMPONENTS	
• Check for correct wheel and tire size, front-to-rear and side-to-side. • Check for excessive bearing end play. • Check the anti-lock brake sensor indicator for a bent sensor ring or missing teeth. • **Are the conditions OK?**	**Yes** GO to G2 . **No** REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
G2 TEST DRIVE THE VEHICLE	
• Enter the following diagnostic	**Yes**

mode on the diagnostic tool: CLEAR the DTCs. • Key in OFF position. • Key in ON position. • Test drive the vehicle over 24 km/h (15 mph). • Enter the following diagnostic mode on the diagnostic tool: Retrieve DTCs. • **Is DTC C1222 retrieved?**	INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** If another DTC is retrieved, GO to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) index. If no DTCs are retrieved, system is OK.

PINPOINT TEST H: DTC C1233 (LF), C1234 (RF), C1235 (RR), C1236 (LR), ANTI-LOCK BRAKE SENSOR INPUT SIGNAL MISSING

Test Step	Result / Action to Take
H1 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR	
• Check the suspect anti-lock brake sensor mounting. • Check the suspect anti-lock brake sensor for excessive dirt build up, obstructions, and damage. • **Is the suspect anti-lock brake sensor and mounting OK?**	**Yes** GO to H2 . **No** REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
H2 CHECK THE SUSPECT ANTI-LOCK BRAKE SENSOR INDICATOR	
• Check the suspect anti-lock brake sensor indicator for corrosion, nicks, bridged teeth, damaged teeth, correct mounting, and alignment with the anti-lock brake sensor. • Check the air gap and bearing end play. • **Is the suspect anti-lock brake sensor indicator OK?**	**Yes** GO to H3 . **No** INSTALL a new anti-lock brake sensor indicator; REFER to Sensor Indicator—Front or Sensor Indicator—Rear . CLEAR the DTCs. REPEAT the self-test.
H3 CHECK THE ANTI-LOCK BRAKE SENSOR OUTPUT	
• Key in ON position. • Enter the following diagnostic mode on the diagnostic tool: CLEAR the DTCs. • Key in OFF position. • Key in ON position. • Have an assistant monitor the anti-lock brake control module PIDs LF_WSPD, RF_WSPD, LR_WSPD, and RR_WSPD while driving at various speeds. • **NOTE:** the vehicle must be driven 16 km (10 miles) during this test step. • Test drive the vehicle for 16 km (10 miles). • **Are the anti-lock brake control module PIDs approximately the same at all times?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . REPEAT the self-test. **No** INSTALL a new anti-lock brake sensor; REFER to Sensor—Front or Sensor—Rear . CLEAR the DTCs. REPEAT the self-test.

PINPOINT TEST I: THE YELLOW ABS WARNING INDICATOR DOES NOT SELF-CHECK

Test Step	Result / Action to Take
I1 CHECK THE ABS WARNING INDICATOR CIRCUITRY	
• Key in OFF position. • Disconnect: Anti-Lock Brake Control Module C141. • Key in ON position. • Depress and release the shorting bar connector internal to the anti-lock brake control module C141, harness side, while checking the yellow ABS warning indicator in the instrument cluster. • **Does the yellow ABS indicator illuminate with the shorting bar released and OFF with the shorting bar depressed?**	**Yes** INSTALL a new anti-lock brake control module; REFER to Module . TEST the system for normal operation. **No** REFER to Section 413-01 .

PINPOINT TEST J: SPONGY BRAKE PEDAL WITH NO WARNING INDICATOR

Test Step	Result / Action to Take
J1 CHECK THE VEHICLE COMPONENTS	
• Check the brake pedal and power booster/brake master cylinder for correct attachment. • **Are the components OK?**	**Yes** GO to J2 . **No** REPAIR as necessary. TEST the system for normal operation.
J2 BLEED THE BRAKE SYSTEM	
• Bleed the brake system; REFER to Section 206-00 . • Check for spongy brake pedal. • **Is the brake pedal spongy?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** The brake system is OK. TEST the system for normal operation.

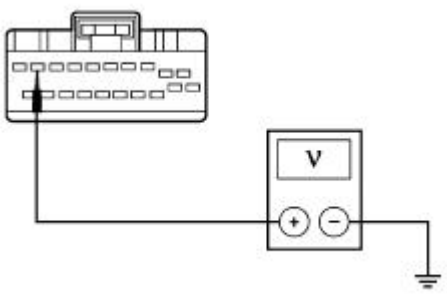
PINPOINT TEST K: POOR VEHICLE TRACKING DURING ANTI-LOCK FUNCTION

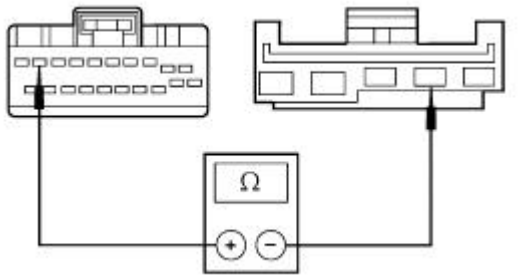
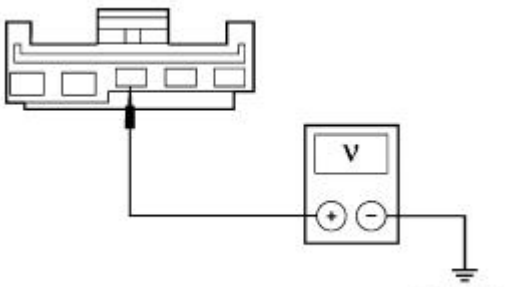
Test Step	Result / Action to Take
K1 BLEED THE BRAKE SYSTEM	
• Bleed the brake system; REFER to Section 206-00 . • Check for vehicle tracking poorly. • **Does the vehicle track poorly?**	**Yes** GO to K2 . **No** The brake system is OK. TEST the system for normal operation.
K2 CHECK THE LF ABS VALVE OPERATION	
• Lift the vehicle and rotate all the wheels to make sure they rotate freely (the vehicle must be in neutral). • **NOTE:** Trigger must be depressed twice. Each depress runs the pump motor for two seconds.	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No**

• Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the LF wheel while the pump motor is running. • **Does the LF wheel rotate?**	GO to K3 .
K3 CHECK THE LF ABS VALVE RELEASE • Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command LF INLET and LF OUTLET. • **NOTE:** Trigger must be depressed twice. Each depress runs the pump motor for two seconds. • Have an assistant rotate the LF wheel immediately after depressing trigger. • **Does the LF wheel rotate?**	**Yes** GO to K4 . **No** GO to K10 .
K4 CHECK THE RF ABS VALVE OPERATION • **NOTE:** Trigger must be depressed twice. Each depress runs the pump motor for two seconds. • Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the RF wheel while the pump motor is running. • **Does the RF wheel rotate?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** GO to K5 .
K5 CHECK THE RF ABS VALVE RELEASE • Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command RF INLET and RF OUTLET. • **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. • Have an assistant rotate the RF wheel immediately after depressing trigger. • **Does the RF wheel rotate?**	**Yes** GO to K6 . **No** GO to K10 .
K6 CHECK THE LR ABS VALVE OPERATION • **NOTE:** Trigger must be depressed twice. Each depress runs the pump motor for two seconds. • Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the LR wheel while the pump motor is running. • **Does the LR wheel rotate?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** GO to K7 .
K7 CHECK THE LR ABS VALVE RELEASE • Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command LR INLET and LR OUTLET. • **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. • Have an assistant rotate the LR wheel immediately after depressing trigger. • **Does the LR wheel rotate?**	**Yes** GO to K8 . **No** GO to K10 .

K8 CHECK THE RR ABS VALVE OPERATION	
• **NOTE:** Trigger must be depressed twice. Each depress runs the pump motor for two seconds. • Trigger the anti-lock brake control module active command PMP MOTOR ON for four seconds. • Apply moderate brake pedal effort. • Have an assistant attempt to rotate the RR wheel while the pump motor is running. • **Does the RR wheel rotate?**	**Yes** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation. **No** GO to K9 .
K9 CHECK THE RR ABS VALVE RELEASE	
• Apply moderate brake pedal effort. • Trigger the anti-lock brake control module active command RF INLET and RF OUTLET. • **NOTE:** The scan tool will energize the valves for only two seconds per trigger press. • Have an assistant rotate the RR wheel immediately after depressing trigger. • **Does the RR wheel rotate?**	**Yes** The ABS system is operating correctly. **No** GO to K10 .
K10 CHECK FOR DTCS	
• Carry out the anti-lock brake control module self-test. • **Are any DTCs retrieved?**	**Yes** GO to the Anti-Lock Brake Control Module Diagnostic Trouble Code (DTC) Index. **No** INSTALL a new HCU; REFER to Hydraulic Control Unit . TEST the system for normal operation.

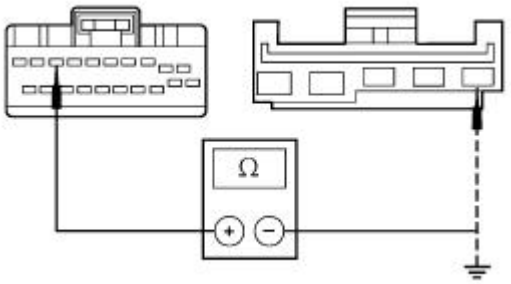
PINPOINT TEST L: THE TRACTION CONTROL IS INOPERATIVE—DOES NOT OPERATE CORRECTLY

Test Step	Result / Action to Take
L1 CHECK THE TRACTION CONTROL SWITCH CIRCUITRY	
• Key in OFF position. • Disconnect: Instrument Cluster C251. • Key in ON position. • Measure the voltage between instrument cluster C251 Pin 9, Circuit 959 (GY), harness side and ground, while depressing and releasing the traction control switch.  GH2586-A • **Is the voltage greater than 10 volts with the traction control switch depressed and zero volts with the traction control switch released?**	**Yes** INSTALL a new instrument cluster, REFER to Section 413-01 . TEST the system for normal operation. **No** GO to L2 .

L2 CHECK CIRCUIT 959 (GY) FOR AN OPEN	
• Key in OFF position. • Disconnect: Traction Control Switch C239. • Measure the resistance between instrument cluster C251 Pin 9, Circuit 959 (GY), harness side and traction control switch C239 Pin 4, Circuit 959 (GY), harness side.  GH2587-A • **Is the resistance less than 5 ohms?**	**Yes** GO to L3 . **No** REPAIR the circuit. TEST the system for normal operation.
L3 CHECK CIRCUIT 489 (PK/BK) FOR AN OPEN	
• Key in ON position. • Measure the voltage between traction control switch C239 Pin 3, Circuit 489 (PK/BK), harness side and ground.  GH2588-A • **Is the voltage greater than 10 volts?**	**Yes** INSTALL a new traction control switch. TEST the system for normal operation. **No** REPAIR the circuit. TEST the system for normal operation.

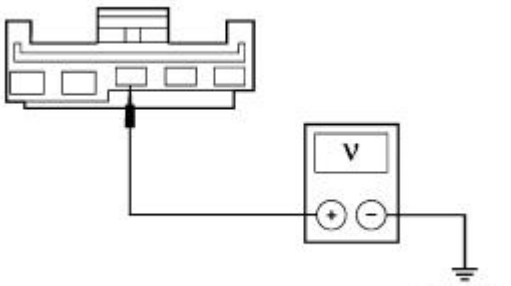
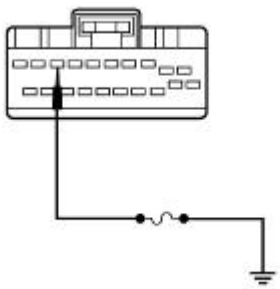
PINPOINT TEST M: THE TRACTION CONTROL INDICATOR IS INOPERATIVE—TRACTION CONTROL SWITCH

Test Step	Result / Action to Take
M1 CHECK CIRCUIT 960 (BK/LB)	
• Key in OFF position. • Disconnect: Instrument Cluster C251. • Disconnect: Traction Control Switch C239. • Measure the resistance between instrument cluster C251 Pin 8, Circuit 960 (BK/LB), harness side and traction control switch C239 Pin 5, Circuit 960 (BK/LB), harness side; and between instrument cluster C251 Pin 8, Circuit 960 (BK/LB), harness side and ground.	**Yes** GO to M2 . **No**



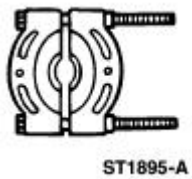
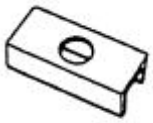
GH2589-A

- **Is the resistance less than 5 ohms between the instrument cluster and traction control switch and greater than 10,000 ohms between instrument cluster and ground?**

M2 CHECK CIRCUIT 489 (PK/BK) FOR AN OPEN	
• Key in ON position. • Measure the voltage between traction control switch C239 Pin 3, Circuit 489 (PK/BK), harness side and ground.  GH2588-A • **Is the voltage greater than 10 volts?**	**Yes** GO to M3 . **No** REPAIR the circuit. TEST the system for normal operation.
M3 CHECK THE TRACTION CONTROL SWITCH INDICATOR	
• Key in OFF position. • Connect: Traction Control Switch C239. • Key in ON position. • Momentarily connect a fused (10A) jumper wire between instrument cluster C251 Pin 8, Circuit 960 (BK/LB), harness side and ground, while observing the traction control switch indicator.  GH2590-A • **Does the traction control switch indicator illuminate?**	**Yes** INSTALL a new instrument cluster; REFER to Section 413-01 . TEST the system for normal operation. **No** INSTALL a new traction control switch. TEST the system for normal operation.

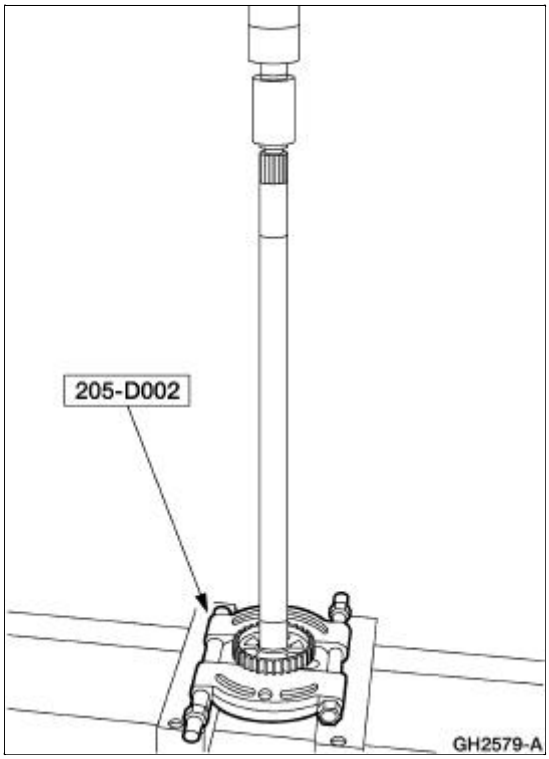
Sensor Indicator —Rear

Special Tool(s)

 ST1895-A	Pinion Bearing Cone Remover 205-D002 (D79P-4621A)
 ST1254-A	Axle Bearing/Seal Plate 205-090 (T75L-1165-B)
ST1713-A	Sensing Ring Replacer 206-041 (T89P-20202-A)

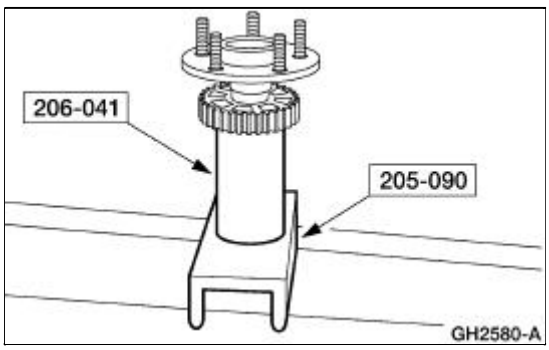
Removal

1. Remove the rear axle shaft bearing, refer to Section 205-02A or Section 205-02B .
2. Using the special tool, remove the anti-lock brake sensor indicator from the axle shaft.

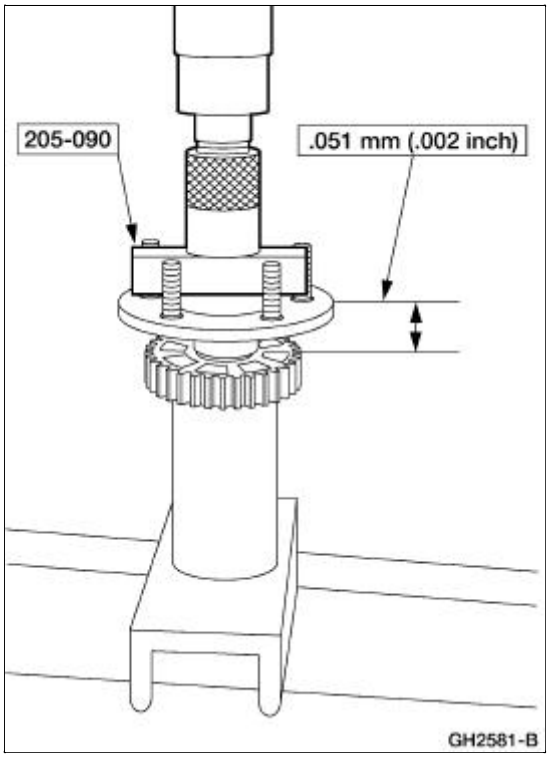


Installation

1. Using the special tools, align the rear anti-lock brake sensor indicator to the rear axle shaft.



2. Using the special tools, press the rear anti-lock brake sensor on the rear axle shaft to specification.

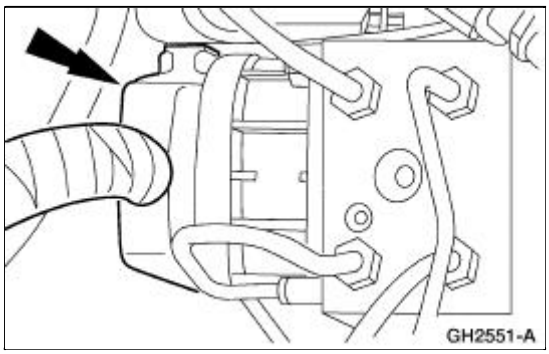


3. Install the rear axle shaft bearing, refer to Section 205-02A .

Hydraulic Control Unit

Removal

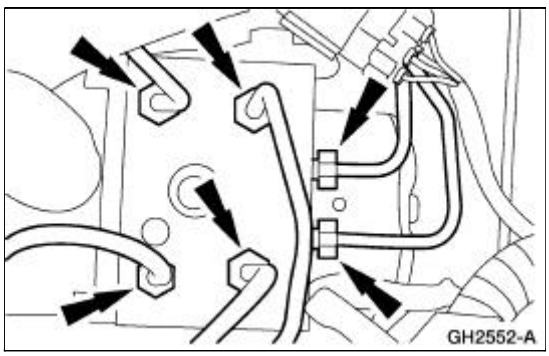
1. Disconnect the battery ground cable(14301).
2. Disconnect the anti-lock-brake control module electrical connector.



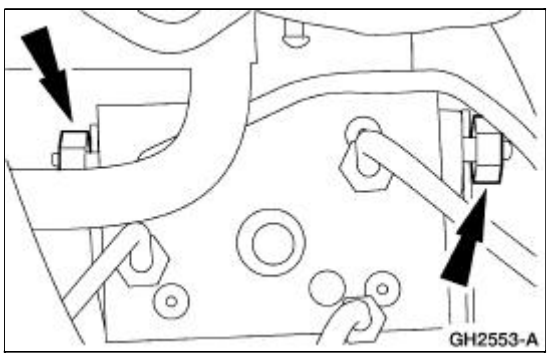
3. **NOTE:** The 4 wheel anti-lock brake system (4WABS) with traction control is shown , the 4WABS without traction control system is similar with one less hydraulic line.

   NOTE: Plug brake lines to prevent any brake fluid loss.

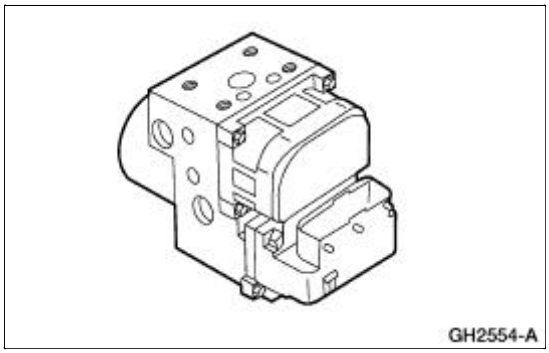
   Disconnect the brake lines from the hydraulic control unit (HCU).



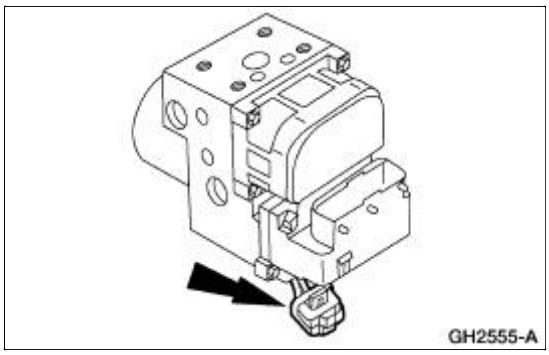
4. Remove the HCU bracket nuts to HCU.



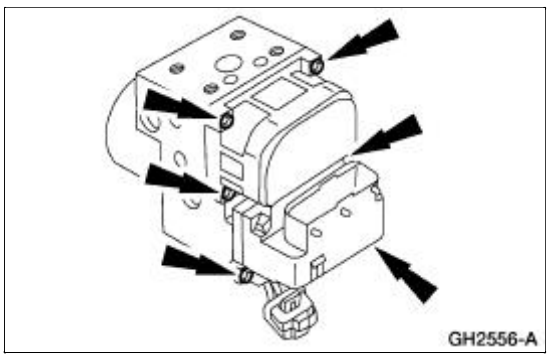
5. Remove the HCU.



6. Remove the pump motor electrical connector.



7. Remove the anti-lock-brake control module screws.

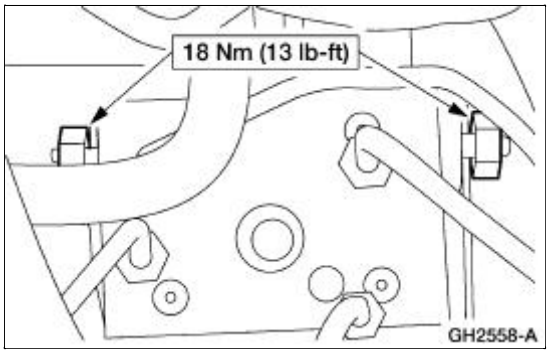


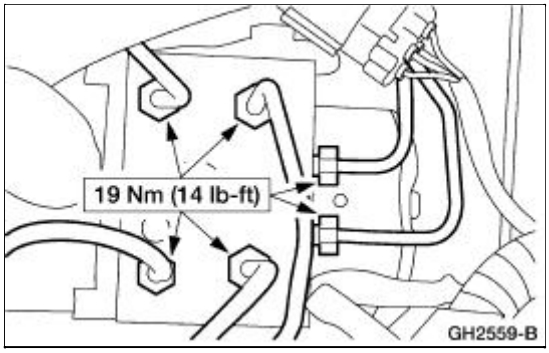
8. Remove the anti-lock-brake control module from the HCU.

Installation

1. **NOTE:** The brake system must be bled after the HCU is installed or replaced. Refer to Section 206-00 .

   To install, reverse the removal procedure.

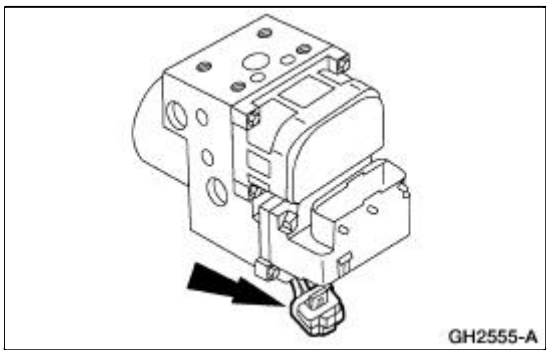

18 Nm (13 lb-ft)
GH2558-A


19 Nm (14 lb-ft)
GH2559-B

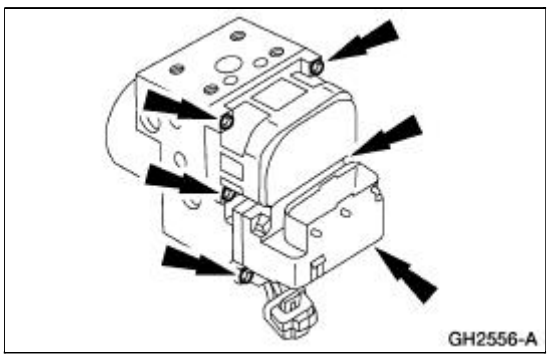
Module

Removal

1. Remove the hydraulic control unit (HCU). Refer to Hydraulic Control Unit .
2. Remove the pump motor electrical connector.



3. Remove the anti-lock-brake control module screws.



4. Remove the anti-lock-brake control module from the HCU.

Installation

1. **NOTE:** The brake system must be bled after the HCU is installed or replaced. Refer to Section 206-00 .

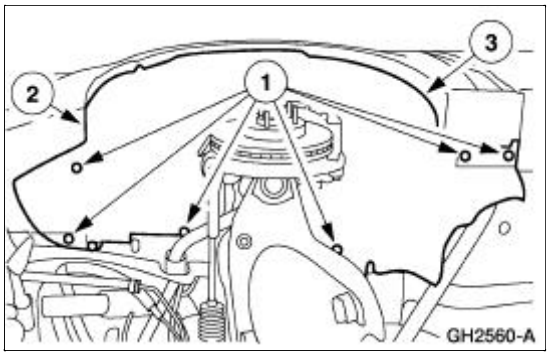
   To install, reverse the removal procedure.

Sensor —Front

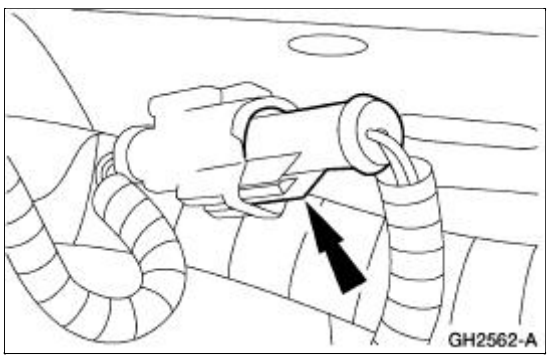
Removal

1. Remove the wheel and tire assembly. For additional information, refer to Section 204-04 .

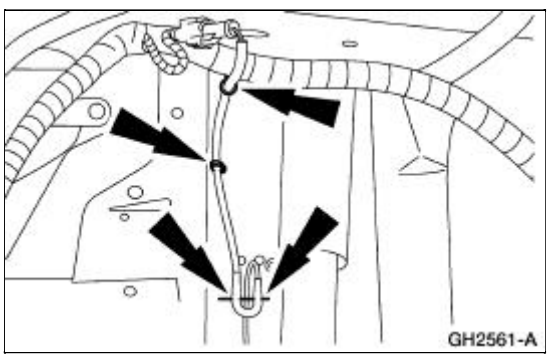
2. Remove the inner fender splash shield.
    1. Remove the inner fender splash shield push pins.
    2. Remove the inner fender splash shield screw.
    3. Remove the inner fender splash shield.



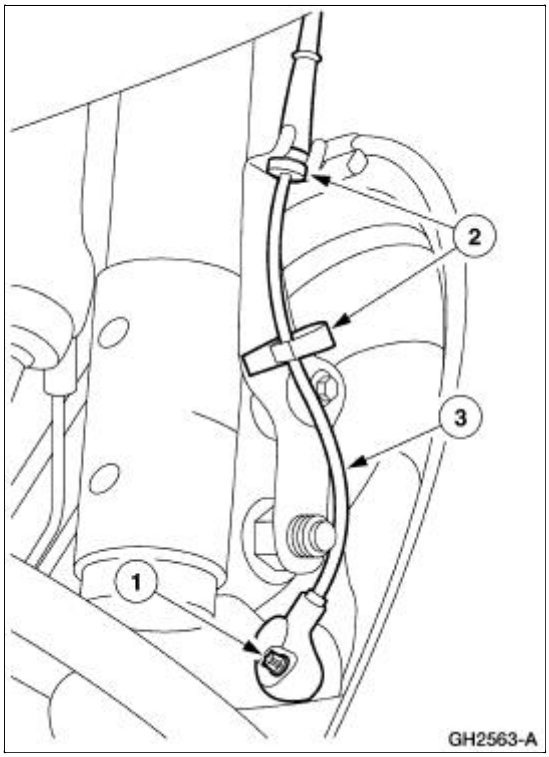
3. Remove the front anti-lock brake sensor electrical connector.



4. Remove the front anti-lock brake sensor harness from the anti-lock brake sensor harness clips.

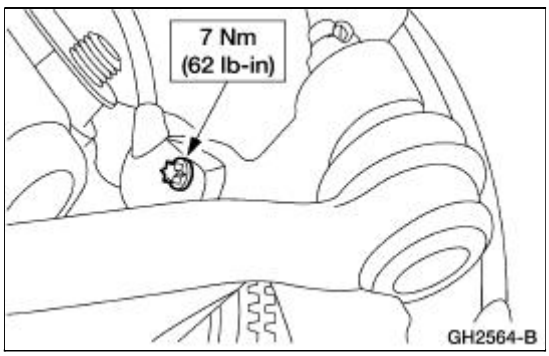


5. Remove the front anti-lock brake sensor.
    1. Remove the front anti-lock brake sensor bolt.
    2. Remove the anti-lock brake sensor harness from the harness clips.
    3. Remove the front anti-lock brake sensor.



Installation

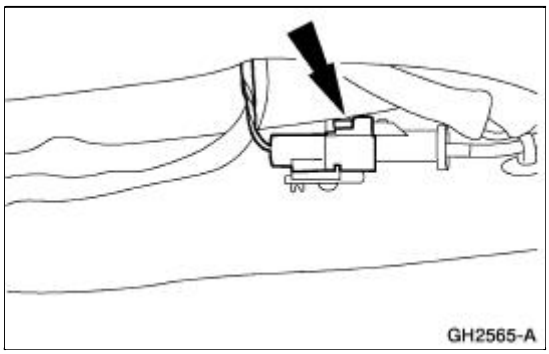
1. To install, reverse the removal procedure.



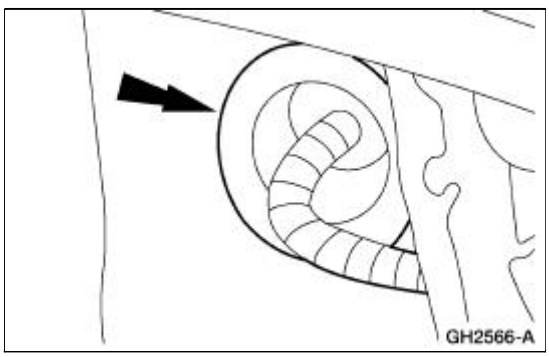
Sensor —Rear

Removal

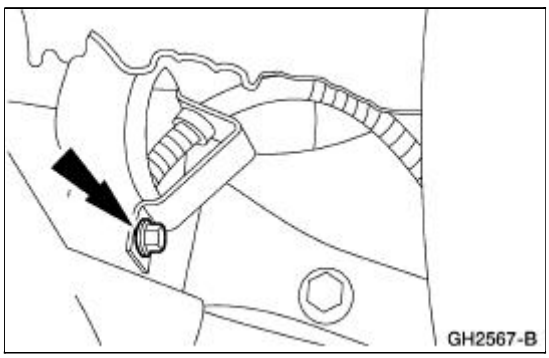
1. Remove the rear passenger seat.
2. Disconnect the rear anti-lock brake sensor electrical connector.



3. Raise and support the vehicle. For additional information, refer to Section 100-02 .
4. Remove the rear anti-lock brake sensor harness from the floor pan.



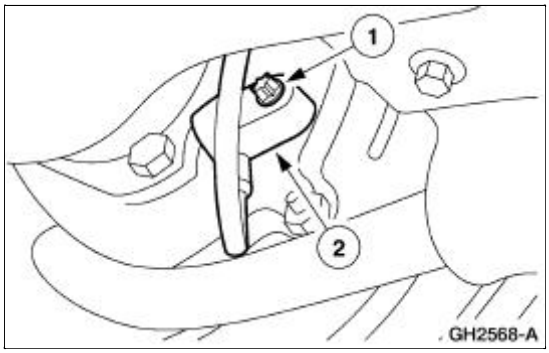
5. Remove the anti-lock brake sensor harness bracket bolt.



6. **NOTE:** The sensor may be siezed to the axle. Use Rust Penetrant and Inhibitor F2AZ-19A501-A meeting Ford specification ESR-M99C56-A to loosen the sensor for removal.

   Remove the rear anti-lock brake sensor.

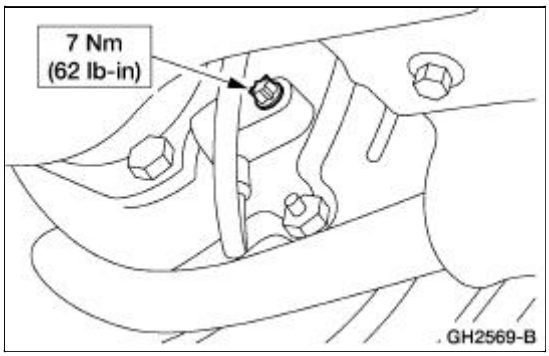
1. Remove the rear anti-lock brake sensor bolt.
2. Remove the rear anti-lock brake sensor.



Installation

1. **NOTE:** Be sure to apply High Temperature Nickel Anti-Sieze Lubricant F6AZ-9L494-AA meeting Ford specification ESE-M124A-A to the sensor body where it will make contact when installed.

   To install, reverse the removal procedure.

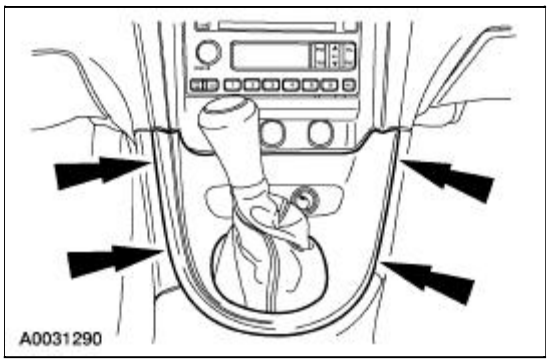


Switch —Traction Control

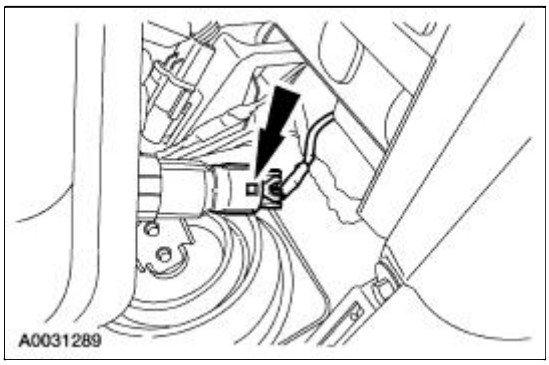
Removal and Installation

1. **NOTE:** If the vehicle is equipped with an automatic transmission, position the shift lever in the 1 position before detaching the floor console finish panel.

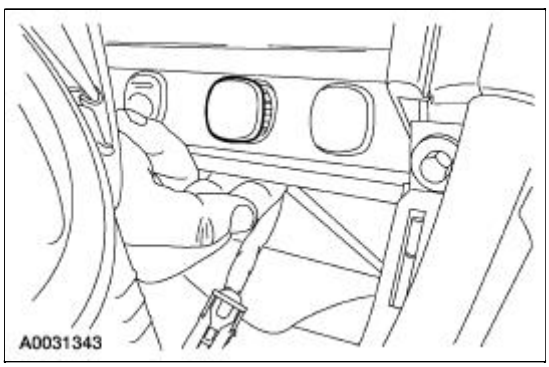
   Lifting from both sides, detach the floor console finish panel.



2. Disconnect the electrical connector and position the finish panel out of the way.



3. Reaching behind the center finish panel, push and detach the switch from the finish panel.



4. Disconnect the electrical connector and remove the switch.

5. To install, reverse the removal procedure.